

## ORIGINAL ARTICLE

# SUBURBAN BREASTFED INFANTS IN KLANG VALLEY ARE AT HIGHER RISK OF DIOXINS TOXICITY

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### ABSTRACT

Dioxins are a most toxic compound ever studied by human until today. Their significant health effects involved all ranges of age, including infants due to exposure to contaminated breast milk. The objective of the study was to appraise the status of dioxin contamination in breast milk among postnatal mothers live in urban and suburban areas in Klang Valley. It was conducted as a cross sectional study involving 101 postnatal mothers who came for their infant second hepatitis B vaccination. The samples were analysed using High Resolution Gas Chromatography (HRGC) following the USEPA Method 8290. About 70.3% of the samples were found detected with dioxin congeners. More suburban mothers have positive breast milk dioxins compared to urban mothers, 100.0% and 67.0% respectively. Significant associated factors include high fat daily intake ( $p=0.013$ ), high milk daily intake ( $p=0.044$ ), high meat daily intake ( $p=0.001$ ), body mass index more than  $30 \text{ kg/m}^2$  ( $p=0.005$ ), and body fat % of more than 26% ( $p=0.046$ ). In conclusion, amount daily intake of fat diet, meat, milk, body mass index and body fat are significant associated factors for the present of dioxins in breast milk among postnatal mothers in Klang Valley. More suburban mothers contain dioxins in their breast milk, which poses higher risk of health problems among their infants. A comprehensive study need to be conducted and regular followup need to be established in monitoring the future severity of maternal breast milk contamination to ensure the health of the next generations.

**Keywords:** dioxins, breast milk, suburban, urban, postnatal mothers

### INTRODUCTION

Dioxins are among the most toxic chemical compound produced as the result of human activities such as industrial by-products<sup>1,2</sup>, agricultural wastes<sup>3,4</sup>, uncontrolled open burning<sup>5,6</sup>, traffic emission<sup>7</sup>, and incineration<sup>8,9</sup>. Due to its high lipophilic properties, after being released into the environment, the compound is able to contaminate the ambient air, surface water bodies, soil and later bioaccumulate in our food chain<sup>10,11</sup>. Dioxins exposure appear to disrupt the physiological function of the immune<sup>12, 13</sup>, hormone<sup>14,15</sup>, reproductive<sup>15,16</sup> and nervous<sup>17,18</sup> systems of human beings. More seriously, they also capable of affecting fetus growth<sup>19,20</sup> and development<sup>21,22</sup>, cognitive and learning abilities of growing children<sup>23</sup>.

Human breast milk was found not spare from being contaminated by this compound. Studies have shown high concentration of dioxins were detected in mothers' milk in many countries<sup>24, 25, 26, 27, 28</sup>. This carcinogen class A compound poses dangerous consequences to those growing breastfed infants.

There were very few studies that been carried out in Malaysia and published. One study on oil palm soils found a very high concentration of dioxin especially those areas closed to major roads or industrial parks<sup>29</sup>. One study in northern of Peninsular Malaysia obtained the dioxins breast milk concentrations from 3.4 to 24 pgTEQs/g lipid

weight which were exceeded the standard<sup>30</sup>. The objectives of this study were to compare the breast milk dioxins concentrations between urban and suburban postnatal mothers in Klang Valley, together with their predisposing factors.

### MATERIAL AND METHODS

The study was conducted using as a cross sectional study design with the collaboration of local health office in the year 2000. The study participants consisted of 101 breastfeeding mothers (91 from urban and 10 from suburban). Inclusion criteria comprise that the mothers are healthy without any chronic diseases, in the postnatal period between the 2<sup>nd</sup> and 6<sup>th</sup> week, and aged between 18 to 45-year-old. Participants were chosen using purposive sampling among those mothers who came to selected health clinic for their infant Hepatitis B second dose vaccination. About 5 to 10mls of breast milk been collected and kept in a sterile universal bottle and stored under  $-20^{\circ} \text{C}$  until analysed. Other information like food habits (24 hours dietary recall) and anthropometric measurement were collected using a standardised questionnaire.

All 17 congeners of dioxins in each sample were quantified by High Resolution Gas Chromatography (HRGC) at an accredited Doping Control Centre using analytical USEPA Method 8290. Statistical analyses were performed using Statistic Packages for Social Sciences (SPSS) for tests of means, and t-test with p value of less than 0.05 as the significant limit.

**RESULTS**

From 101 breast milk samples analysed, 71 (70.3%) samples were found contaminated with dioxins. The prevalence of suburban mother’s breast milk contamination with dioxins was found higher than urban mothers, 100.0% and 67.0% respectively. Suburban areas were those households located in the vicinity of Klang Valley.

The mean for dioxins in breast milk for urban mothers was 0.06 (SD ± 0.13) pg/gram fat with maximum value of 0.68 pg/gram fat milk; and for suburban mothers was 0.19 pg/gram fat with maximum value of 0.29 pg/gram fat milk (Table

1). However, both were still below the maximum allowable limit by USFDA (1.0 pg I-TEQ/gram fat) and far below to another study done in Penang and Kedah<sup>30</sup>.

About four mothers took more than 60 grams of fat per day and they were found to have a higher mean of 0.23 (±0.30) pg I-TEQ dioxins / gram fat milk. This was significantly higher compared to mothers who took less fat per day (p<0.05). Similarly, higher daily intake of milk (p<0.05) and meat (p<0.01) products found to be associated with higher breast milk dioxin levels.

Respondents with their body mass index of ≥ 30kg/m<sup>2</sup> were found to have a higher dioxins mean concentration of 0.18 (±0.23) pg I-TEQ/gram compared to those with the index less than 30 (p<0.01). The study also found that those participants with body fat percentages of 26% or more, have a significant higher dioxin level in breast milk (p<0.05) compared to those with lesser body fat.

**Table 1. Level of Dioxins in Breast Milk According to Respondents Characteristics**

Variables	Dioxin Level (pg I-TEQ/g)	
	Arithmetic mean (± SD)	Significant level
Location		
Urban	0.06 (± 0.13)	
Suburban	0.19 (± 0.10)	
Daily fat intake > 60 gram	0.23 (± 0.30)	p = 0.013*
High daily milk intake	0.09 (± 0.16)	p = 0.044*
High daily meat intake	0.11 (± 0.17)	p = 0.001**
Body mass index ≥ 30kg/m <sup>2</sup>	0.18 (± 0.23)	p = 0.005**
Body fat ≥ 26%	0.09 (± 0.16)	p = 0.046*

\* p < 0.05; \*\*p < 0.01

Calculation for an average daily intake for breastfed infants was based on the assumption of infant body weight of 5 kilograms and consumed about 700 millilitre (22.4gm fat) of breast milk per day. For breast-fed urban motherhood infants and suburban mother infants, their average daily intake values were 0.27 and 0.85 pg I-TEQ/kg/day respectively. Suburban infants exposed to three times higher of the risks of dioxin intake compared to urban infants. Fortunately, both values were lesser than the tolerable daily intake (WHO), which is 1 to 4 pg I-TEQ/kg/day.

**DISCUSSION**

To measure a status of dioxin contamination in a population, biological monitoring such as fatty tissue, blood, serum, red blood cell or breast milk has usually been chosen. In this study, breast milk sampling being done because it is not invasive,

cheap, easily done and convenience of the participants. Breast milk is a good medium because its fat content suitable for laboratory analyses. Serum has lesser fat content and this may lower the dioxin level below true value<sup>31</sup>.

Quantifying of dioxins in breast milk has two advantages, first it uses to measure the exposure of the mother to dioxins, secondly to show the level of dioxin contamination into the breast-fed infant. The infant may also expose to dioxins during antenatal periods through the placental circulation into a fetus blood system.

The means of dioxins in breast milk in urban and suburban areas in the Klang Valley were very much low compared to other similar study before<sup>30</sup>. There was a significant relationship between high dietary fat content, eat milk and meat every day with the dioxin concentration in breast milk<sup>32, 33,34,35</sup>.

This study found that those participants with body mass index of 30kg/m<sup>2</sup> or more will have higher breast milk dioxin concentration. Together with that, participants with body fat percentage of 26 or more will also have higher dioxin level in their breast milk. Similarly, those with more fat body have higher breast milk dioxins found by other studies<sup>36, 37</sup>.

**CONCLUSION**

Even though there was evidence of breast milk contamination with dioxins in Kalng Valley, it was still at an early stage with very low concentration of dioxins. The identified associated factors are poor diet and excessive body fat. It is recommended that dioxin contamination should be further investigated at high risk areas in a bigger population regularly. In addition, even the level was low, the adverse health effect was still uncertain because of its ability to cause toxic effect at multiple threshold level including at a low dose of exposure.

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