

Lead exposure during breastfeeding

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ABSTRACT

QUESTION Owing to the recent concerns of lead (Pb) leaking into tap water, one of our female patients is concerned about the effects of Pb exposure to newborns while breastfeeding. How should I advise her and should she switch to formula feeding?

ANSWER Lead exposure through drinking tap water while breastfeeding is not associated with any serious concerns in most available studies. There is currently no safe level of Pb exposure, but environmental exposure within Canada is low. At present, Pb levels in drinking water are carefully monitored by Health Canada and are not likely to be of concern to breastfeeding mothers. Switching to formula feeding is not necessary and not recommended, as improperly prepared formula can have higher Pb levels.

RÉSUMÉ

QUESTION À la lumière des récentes inquiétudes à propos de la présence de plomb (Pb) dans l'eau du robinet, une de mes patientes s'inquiète des effets de l'exposition au plomb chez les nouveau-nés qui sont allaités. Quels conseils devrais-je lui donner, et devrait-elle plutôt donner du lait maternisé?

RÉPONSE Dans la plupart des études publiées, on ne parle pas d'inquiétudes sérieuses à propos de l'exposition au Pb dans l'eau du robinet pendant l'allaitement. On n'a pas encore établi de taux sécuritaires d'exposition au Pb, mais l'exposition environnementale au Canada est faible. À l'heure actuelle, les taux de Pb présents dans l'eau potable sont étroitement surveillés par Santé Canada et ne devraient pas causer d'inquiétudes aux mères qui allaitent. Il n'est pas nécessaire ni recommandé de donner plutôt du lait maternisé, parce que si on le prépare mal, le lait maternisé peut contenir des taux plus élevés de Pb.

Lead (Pb) is ubiquitous in our environment. Because of the concern of Pb in drinking water, urban cities are replacing Pb water pipes, which were used during house construction before the 1950s. Other sources of Pb exposure include industrial pollution and hazards through occupations related to mining, household renovation, battery or automobile manufacturing, and the production of plastics, ceramics, paints, and pigments.¹

Lead accumulates in bones and remains in the body for a long period of time. Owing to the increased demand for calcium during pregnancy and lactation, calcium from bone is released along with Pb²; this mobilizes Pb stored in the bones, resulting in higher Pb levels in the blood. According to a study,³ Pb redistributed from tissues into blood might have a greater effect on blood-Pb levels than dietary intake does, unless Pb is directly consumed. Currently, there is no safe level of Pb exposure; however, the World Health Organization established provisionally tolerable weekly intakes of 3.75 µg/kg daily.⁴ The World Health Organization also reported 2 to 5 ng/g to be acceptable Pb levels in breast milk⁵ and 10 µg/L as the safe limit of Pb in drinking water.⁶ Health Canada enforces this restriction through routine monitoring of tap water. However, some researchers have suggested that the acceptable Pb levels should be lowered to 1.2 to 1.3 µg/kg daily in young children and pregnant women.⁷

Lead poisoning is known to adversely affect neuro-psychologic development.⁸ According to a study from Boston, Mass, blood-Pb levels greater than 10 µg/dL were associated with lower neurobehavioural performance, as measured by the Bayley Scales of Infant Development at 6 to 18 months of age.⁹ Several studies have concluded that Pb in breast milk does depend on the level of maternal exposure, but that the absolute degree of transfer is controversial. Comparison of blood and breast milk samples in northern Ontario indicated a low milk-to-blood ratio (0.09),¹⁰ which suggests that the mammary gland barrier is effective in maintaining a low transfer between maternal blood-Pb levels and breast milk. Although studies indicate a low milk-to-blood ratio, samples of breast milk-Pb levels vary extensively.

At present, most studies agree that Pb poisoning through breast milk is only a concern if the mother has high blood-Pb levels. A study conducted in Toronto, Ont, showed that pregnant women had average blood-Pb levels of 2.9 µg/dL and only 1 in 95 women had blood-Pb levels greater than 9.9 µg/dL.¹¹ Lead levels that are sufficiently high for concern (>10 µg/dL) are rarely exhibited in urban areas in Canada. Levels of Pb contamination in drinking water from Pb pipes are not sufficiently high to greatly increase Pb levels in breast milk and are typically lower than the tolerable range of Pb exposure. While

there are reports of Pb poisoning caused by drinking water,^{12,13} there are currently no reported cases of Pb poisoning in infants attributed to breastfeeding mothers who have been exposed to Pb through drinking water. Therefore, continued breastfeeding is recommended for mothers whose blood-Pb levels are not excessively high.

Airborne lead

Employees who are exposed to airborne Pb levels above 30 µg/m³ are required by the Occupational Safety and Health Administration to have their blood-Pb levels measured every 6 months and routinely complete a zinc protoporphyrin (ZPP) test. Zinc protoporphyrin levels increase exponentially above 40 µg/dL (400 µg/L) blood-Pb levels, but a paucity of data on the blood-Pb–ZPP correlations and ZPP levels associated with adverse health effects limits its usefulness in determining Pb toxicity.⁶ Although the normal range of ZPP is 32 to 69 µmol/mol of heme,¹⁴ ZPP is relatively higher in preterm neonates or in those suffering from hypoxemia.¹⁵ Moreover, while ZPP levels do correlate with blood-Pb levels, there is considerable individual variability of ZPP measurements and poor sensitivity to Pb exposure at low ranges.¹⁶ The pediatric reference range for ZPP is 16.6 to 73.6 µmol/mol of heme in females and 15.6 to 63.5 µmol/mol of heme in males, from birth to 12 months old,¹⁷ when most breastfeeding is completed. However, little research has been completed regarding the accuracy of ZPP tests in determining Pb poisoning, so this test should only be used in conjunction with a blood-Pb measurement.

Conclusion

Mothers who have a history of Pb poisoning or who are sustaining high levels of occupational Pb exposure might have high blood-Pb levels. These mothers should be routinely monitored. If maternal blood-Pb levels are excessively high, the breastfed infants should also be observed.

Switching to formula feeding is not recommended as a method to avoid urban Pb exposure. Cow's milk, the most utilized source of milk in diets of non-breastfed infants, can be a source of Pb due to the bone meal used for cattle feed¹⁸ and can increase risks of iron deficiency.¹⁹ Furthermore, during preparation, infant formulas also tend to be overconcentrated, which can further elevate Pb intake.^{20,21} In summary, it is recommended that unless maternal blood-Pb levels are excessively high, breastfeeding should continue. ❁

Competing interests

None declared

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MOTHERISK

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Do you have questions about the effects of drugs, chemicals, radiation, or infections in women who are pregnant or breastfeeding? We invite you to submit them to the Motherisk Program by fax at 416 813-7562; they will be addressed in future Motherisk Updates.

Published Motherisk Updates are available on the College of Family Physicians of Canada website (www.cfpc.ca) and also on the Motherisk website (www.motherisk.org).