

Is caffeine consumption safe during pregnancy?

Sara Morgan RPh Gideon Koren MD FRCPC FACMT Pina Bozzo

Abstract

Question I have a pregnant patient who experienced a miscarriage in the past and who has asked me whether her consumption of 2 cups of coffee per day could have caused it. What should I tell her?

Answer There are conflicting data on the fetal safety of dietary caffeine consumption during pregnancy, particularly at levels of 300 mg/d or greater. Although it is difficult to assess the risk of spontaneous abortion with caffeine consumption, most of the data do not suggest an increased risk of adverse pregnancy, fertility, or neurodevelopmental outcomes with caffeine consumption of 300 mg/d or less from all sources. Therefore, consumption of 1 to 2 cups of coffee a day is not expected to be a concern.

La consommation de caféine est-elle sécuritaire durant la grossesse?

Résumé

Question L'une de mes patientes enceintes a vécu un avortement spontané par le passé et m'a demandé si le fait de boire 2 tasses de café par jour pourrait avoir causé sa fausse couche. Que devrais-je lui répondre?

Réponse Les données scientifiques concernant la sécurité pour le fœtus de consommer des aliments contenant de la caféine durant la grossesse, en particulier à des niveaux de 300 mg/j ou plus, sont contradictoires. Quoiqu'il soit difficile d'évaluer le risque d'avortement spontané causé par la consommation de caféine, la plupart des données ne font pas valoir de risque accru d'issues de grossesse indésirables, de problèmes de fertilité ou d'effets sur le développement neurologique lorsque 300 mg/j ou moins de caféine de toutes sources sont consommés. Par conséquent, boire 1 ou 2 tasses de café par jour ne devrait pas causer d'inquiétudes.

Caffeine is one of the most commonly consumed stimulants in the general population.¹ It is found in a variety of foods and beverages, including coffee, tea, chocolate, cocoa products, soft drinks, and energy drinks. In addition, it is increasingly used as an ingredient in prescription and over-the-counter medications for colds, influenza, headache, menstrual symptoms, weight loss, and central nervous system stimulation.

The effects of caffeine on the body are mediated via interaction with a number of receptors, including adenosine, adrenergic, cholinergic γ -aminobutyric acid, and serotonin receptors.¹ The concerns about caffeine use during pregnancy or lactation are owing to the theoretical effects on the fetus: caffeine crosses the placental barrier²; caffeine's elimination half-life increases in late gestation; and infants poorly metabolize caffeine until 3 months of age.³

The amount of caffeine in various food and beverage preparations varies. **Table 1** provides common examples of these foods and beverages and the amount of caffeine that might be expected in each.⁴ However, because the caffeine content can vary depending on the manufacturer or preparation, one needs to consult specific product information for more detail.

Malformations and pregnancy outcomes

Several critical literature reviews have been conducted on potential associations between caffeine and spontaneous abortion, congenital malformations, and fetal growth restriction.⁵⁻⁷ These reviews have considered thousands of pregnancies, as well as a variety of study designs, including case-control and cohort studies. Most of these studies did not evaluate women with caffeine consumption greater than 300 mg/d, corresponding to about 3 cups of instant coffee per day. In addition, many methodologic flaws were recognized, such as lack of control for confounders including smoking and alcohol use.⁵⁻⁷ Smoking is a key concern, as it causes spontaneous abortion, and many women combine coffee consumption with smoking. Overall conclusions include that there is insufficient evidence of a causal association between caffeine use and increase in spontaneous abortions, particularly if less than 300 mg/d is consumed; there is no increased risk of birth defects; and there are insignificant reductions in fetal growth with caffeine consumption of 300 mg/d or less.⁵⁻⁷

Fertility

A European multicentre study retrospectively collected information on time to conception in 3187 women aged

Table 1. Common sources of caffeine

SOURCE	UNIT	CAFFEINE PER UNIT, MG
Coffee		
• Brewed	237 mL (1 cup, 8 oz)	135
• Instant	237 mL (1 cup, 8 oz)	76-106
• Decaffeinated instant	237 mL (1 cup, 8 oz)	5
Tea		
• Average blend	237 mL (1 cup, 8 oz)	43
• Green	237 mL (1 cup, 8 oz)	30
• Instant	237 mL (1 cup, 8 oz)	15
• Decaffeinated	237 mL (1 cup, 8 oz)	0
Soft drinks		
• Cola	355 mL (1 can, 12 oz)	36-46
• Diet cola	355 mL (1 can, 12 oz)	39-50
Cocoa products		
• Chocolate milk	237 mL (1 cup, 8 oz)	8
• Candy (milk chocolate)	28 g (1 oz)	7
• Hot cocoa mix	237 mL (1 envelope, 8 oz)	5

Data from Health Canada.⁴

25 to 44. A significant risk of subfecundity was seen in the first pregnancy for women consuming 500 mg/d or greater of caffeine (odds ratio 1.45, 95% CI 1.03 to 2.04). The authors concluded that high levels of caffeine might delay conception.⁷

A literature review of human studies from 2000 to 2009 assessed the effect of caffeine on fertility outcomes including infertility, semen quality, and various end points of assisted reproductive technology. Overall, the authors reported no positive relationship between caffeine consumption and adverse effects on fertility.⁸ However, owing to methodologic limitations, more studies are needed to corroborate these data.

A 2010 study also reported no association between caffeine consumption (mean 455 mg/d) and success rate of pregnancy after in vitro fertilization.⁹

Neurodevelopmental outcomes

A literature review of studies published between 1975 and 1999 reported minimal effects of caffeine ingestion during pregnancy on neurodevelopment and behaviour in infants and children.¹⁰ However, there have been several cases of caffeine withdrawal reported in infants whose mothers consumed very high amounts of caffeine (greater than 800 mg/d).¹⁰ Overall, the authors concluded that there was little evidence to recommend against consuming moderate amounts of caffeine during pregnancy.

Other studies reported no adverse effects on child behaviour with the consumption of moderate amounts (less than 300 mg/d) of caffeine during pregnancy.¹¹⁻¹³ A cohort study of 885 children born in Brazil demonstrated no increased risk of frequent nocturnal awakening (more than 3 episodes per night) at 3 months postpartum when examining women who consumed an average

of 144 mg/d of caffeine. Almost 20% of mothers were heavy caffeine consumers during pregnancy (300 mg/d or greater), and while the incidence of frequent night awakening in children tended to increase, the difference was not significant when compared with those consuming less than 300 mg/d (22.5% vs 13.5%, $P = .114$).¹⁴

Conclusion

Data about the consumption of caffeine doses of 300 mg/d or less do not suggest increased risk of adverse pregnancy, fertility, or neurodevelopmental outcomes. At this time, the data about caffeine consumption of 300 mg/d or greater are limited and conflicting; therefore, it is best to limit caffeine intake to less than 300 mg/d. The amount of caffeine per cup of coffee varies between products, but as a general rule, consuming 1 to 2 cups of coffee a day is not expected to be a concern. 🌿

Competing interests

None declared

References

1. Fredholm BB, Bättig K, Holmén J, Nehlig A, Zvartau EE. Actions of caffeine in the brain with special reference to factors that contribute to its widespread use. *Pharmacol Rev* 1999;51(1):83-133.
2. Goldstein A, Warren R. Passage of caffeine into human gonadal and fetal tissue. *Biochem Pharmacol* 1962;11:166-8.
3. Aldridge A, Bailey J, Neims AH. The disposition of caffeine during and after pregnancy. *Semin Perinatol* 1981;5(4):310-4.
4. Health Canada [website]. *Food and nutrition. Caffeine in foods*. Ottawa, ON: Health Canada; 2012. Available from: www.hc-sc.gc.ca/fn-an/secureit/addit/caf/index-eng.php. Accessed 2012 Oct 17.
5. Signorello LB, McLaughlin JK. Maternal caffeine consumption and spontaneous abortion: a review of the epidemiologic evidence. *Epidemiology* 2004;15(2):229-39.
6. Brent RL, Christian MS, Diener RM. Evaluation of the reproductive and developmental effects of caffeine. *Birth Defects Res B Dev Reprod Toxicol* 2011;92(2):152-87. Epub 2011 Mar 2.
7. Boltum F, Olsen J, Rebagliato M, Bisanti L. Caffeine and delayed conception: a European multicentre study on infertility and subfecundity. European Study Group on Infertility Subfecundity. *Am J Epidemiol* 1997;145(4):324-34.
8. Peck JD, Leviton A, Cowan LD. A review of the epidemiologic evidence concerning the reproductive health effects of caffeine consumption: a 2000-2009 update. *Food Chem Toxicol* 2010;48(10):2549-76. Epub 2010 Jun 15.
9. Al-Saleh I, El-Doush I, Griselli B, Coskun S. The effect of caffeine consumption on the success rate of pregnancy as well various performance parameters of in-vitro fertilization treatment. *Med Sci Monit* 2010;16(12):CR598-605.
10. Castellanos FX, Rapoport JL. Effects of caffeine on development and behavior in infancy and childhood: a review of the published literature. *Food Chem Toxicol* 2002;40(9):1235-42.
11. Linnert KM, Wisborg K, Secher NJ, Thomsen PH, Obel C, Dalsgaard S, et al. Coffee consumption during pregnancy and the risk of hyperkinetic disorder and ADHD: a prospective cohort study. *Acta Paediatr* 2009;98(1):173-9. Epub 2008 Sep 1.
12. Bekkhus M, Skjøthaug T, Nordhagen R, Borge AI. Intrauterine exposure to caffeine and inattention/overactivity in children. *Acta Paediatr* 2010;99(6):925-8. Epub 2010 Mar 5.
13. Loomans EM, Hofland L, van der Stelt O, van der Wal MF, Koot HM, Van den Bergh BR, et al. Caffeine intake during pregnancy and risk of problem behavior in 5- to 6-year-old children. *Pediatrics* 2012;130(2):e305-13. Epub 2012 Jul 9.
14. Santos IS, Matijasevich A, Domingues R. Maternal caffeine consumption and infant nighttime waking: prospective cohort study. *Pediatrics* 2012;129(5):860-8. Epub 2012 Apr 2.

MOTHERISK Motherisk questions are prepared by the Motherisk Team at the Hospital for Sick Children in Toronto, Ont. Ms Morgan is a doctoral candidate in the Faculty of Pharmacy at the University of Toronto. Dr Koren is Director and Ms Bozzo is Assistant Director of the Motherisk Program. Dr Koren is supported by the Research Leadership for Better Pharmacotherapy during Pregnancy and Lactation. He holds the Ivey Chair in Molecular Toxicology in the Department of Medicine at the University of Western Ontario in London.

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 *Canadian Family Physician* website (www.cfp.ca) and also on the Motherisk website (www.motherisk.org).