THE PATH AHEAD

Environmental Toxins and Infertility

Joseph Pizzorno, ND, Editor in Chief

Abstract

While much of the decrease in fertility worldwide is by choice, an increasing number of couples, especially in industrialized countries, are finding conception more difficult and damaged babies more common. The research is quite clear that metals and chemicals in air, water, food, and health-and-beauty aids are damaging fertility in many ways. These toxicants are causing men to experience relentlessly decreasing sperm count and function while women are suffering progressively worse anovulation, impaired implantation, and loss of fetal viability.

Introduction

Human fertility is declining worldwide. While much of the 50% decrease in the number of children born per woman in the past 60 years is due to choice, an increasing number of couples—now 1 in 7 to 10 in North America—are have serious difficulty conceiving.[1] A significant cause of this progressive loss of fertility is increasing body load of environmental toxins in both men and women.

Environmental toxins cause infertility in basically 4 ways:

- Endocrine disruption.
- Damage to the female reproductive system.
- Damage to the male reproductive system.
- Impaired fetal viability.

This damage not only decreases natural fertility but also makes in vitro fertilization (IVF) much less likely to succeed. The worst fertility disrupters are organochlorine compounds (chlorinated pesticides, polychlorinated biphenyls, and dioxins), bisphenol A (BPA), and organophosphate pesticides and herbicides. However, many other chemicals, metals, and air pollutants seriously damage fertility.

Endocrine Disruption

The key endocrine disruption impairing fertility is loss of blood-sugar control manifesting clinically directly as metabolic syndrome and diabetes and indirectly as abdominal obesity, especially in men, and polycystic ovary syndrome (PCOS). In men with type 2 diabetes, a remarkable 33% suffer hypogonadism.[2] Women with PCOS have substantially lower fertility and if they become pregnant have substantially increased risk for gestational diabetes (OR, 2.9), pregnancy-induced hypertension (OR, 3.7), pre-eclampsia (OR, 3.57), preterm birth (OR, 1.8) and having their babies needing admission to neonatal intensive care (OR, 2.3), and suffering perinatal mortality (OR, 3.1).[3] The huge role of environmental toxins in causing diabetes is more fully discussed in my editorial 16.1.

Chemicals Causing Infertility

As a woman's blood levels of hexachlorocyclohexane, polychlorinated biphenyls (PCBs), and dichlorodiphenyltrichloroethane (DDT) increase, their fertility goes down.[4] Women with the highest levels of PCBs have a serious 50% decrease in their ability to get pregnant[5] and if become pregnant are much more likely to miscarry.[6] In women farmers in Ontario, fertility decreased in proportion to pesticide use.[7,8] The worst pesticides and herbicides appear to be dicamba (49% decrease in fertility), glyphosate (39%), 2,4-D (29%), organophosphates (25%), and thiocarbamates (24%). When infertile couples seek IVF, those with the highest levels of PCBs were much more unlikely to achieve pregnancy.

While it might be easy to dismiss some of these numbers as due to direct or indirect industrial/workplace exposure, nonoccupational exposure is much more

Table 1. Blood Mercury Values in Men and Women With Infertility, Males with Abnormal Sperm Indices, Women With Unexplained Infertility and Controls

Blood mercury levels (ug/L)				
	Infertile group	Sperm abnormalities	Unexplained female infertility	Controls (n = 26)
Males (n = 176)	8.20	8.93		6.30
Females (n = 181)	6.70		7.47	3.53

Note: Summarized from Choy et al.[15]

common and clearly a problem. Women drinking groundwater with tetrachloroethylene (PCE) contamination suffer over a doubled risk of spontaneous abortion as well as increased risk for breast cancer.[9,10]

Chlorination of drinking water was a huge public health success but also caused some unexpected problems. This method of disinfection typically produces four trihalomethane (THM) compounds: chloroform, bromodichloromethane, chlorodibromomethane, and bromoform, as well as other non-THM compounds. Drinking chlorinated water is associated with an increased risk of stillbirth (OR, 2.6).[11] Women drinking chlorinated water were far more likely to deliver a child with smaller body length and smaller head circumference.[12]

In women undergoing IVF, those with the top 25% body load of BPA levels were 211% more likely to have implantation failure.[13]

Men in highest quartile of consumption of high pesticide-residue fruit and vegetables (≥1.5 servings/day) had a 49% lower total sperm count and a 32% lower percentage of morphologically normal sperm as compared to men in the lowest quartile of intake (<0.5 servings/day).[14]

Heavy Metals Damage Fertility

As can be seen in Table 1, a study in Hong Kong found that infertile couples have significantly higher blood levels of mercury than in fertile controls.[15] As Asians eat more seafood than others, their levels are higher than the general population. Mercury is not the only problematic metal.

In a large US study of 501 infertile couples a significant assocation was found between infertility and blood cadmium levels in women (FR, 0.78) and blood lead levels in men (FR, 0.85) (this study did not find an association with mercury—but they excluded fish eaters).[16] In women not occupationally exposed to lead, blood levels above 5 ug/dL (the supposed safe range is below 10 ug/dL) doubles the risk of preterm delivery[17] and increases the rates of spontaneious abortion.[18]

Air Pollutants Cause Infertility

An obvious cause of toxin exposure in the air is tobacco use. As might be expected, women smoking more than 10 cigarettes daily have reduced fertility (OR, 1.6).[19] Since tobacco smoke contains many toxic metals and chemicals, determining which is worst is not clear. Smoking also causes higher rates of ectopic pregnancies and spontaneous abortions, stillbirths (OR, 2.0), and infant mortality (OR, 1.8).[20,21] Cigarette smoking also decreases male fertility, resulting in decresaed sperm density, total sperm count, and number of motile sperm.[22] When Ireland banned smoking in the workplace, rates of preterm births dropped by 25%.[23]

The problem is not just active choices but passive ones as well, such as living near a busy roadway. The closer a women lives near a highway, the higher her rate of infertility.[24,25] Even brief exposure to elevated levels of PM_{10} particulate increases the rate of miscarriage (OR, 2.6).[26] Air pollutants from vehicular exhaust are associated with reduced fertility in males as well.[27,28] Men residing in an industrial town suffered significant reduction in sperm motility and morphology and higher levels of sperm with abnormal chromatin when compared with those living in a rural district with little air pollution.[29] The air pollutants shown to have the biggest impact in this study were PM_{10} and total suspended particulates of SO_2, CO, and NO_x. House-dust levels of flame retardants (PBDEs) also alter sex hormone levels and reduce male fertility.[30]

Summary

This brief editorial reveals just the tip of the iceberg of toxin-induced infertility. Simply consuming foods with a high pesticide level is enough to decrease fertility by a surprising amount. As I have documented in many *IMCJ* edtiorials, this is yet another example of how common environmental pollutants impair health and increase incidence of vertually every disease.

In This Issue

Associate editor, Jeffrey S. Bland, PhD, begins this issue with an important discussion of several key factors involved in the aging process and new technologies becoming available to give us more control over the process. I found of special interest his comments on the work of Valter Longo, PhD, some of which has been published in *IMCJ*. Having personally supervised hundreds of water fasts as part of foundational naturopathic care, I can attest to the efficacy of this intervention in restoring and promoting health. I encourage those wanting to learn

more about this effective intervention to study the work of Alan Goldhammer, DC (who has also been covered in *IMCJ* and is author of the therapeutic fasting chapter in the *Textbook of Natural Medicine*).

George Cody, JD, MA, continues his fascinating "Origins of Integrative Medicine" column. As I read his work and think about the many books I have read written by the pioneers, I continue to be awed by the courageous men and women who were willing to be open minded about what promotes health and what causes disease. Their insights provided the foundation for the emerging medicine documented by this journal. I hope you, dear reader, anticipate each new column as I do.

I will never forget the first time I heard Alessio Fasano, MD, lecture on his team's discovery of zonulin—totally entrancing. I overviewed his work in editorial 12.6 "Zonulin! The Wheat Conundrum Solved (Well, Mostly …)" and think you will find his interview by managing editor Craig Gustafson a great followup.

At *IMCJ*, we work hard to be receptive to nonconventional interventions while also being strongly commited to be doing all we can to ensure accuracy and validity. Obviously, once we leave the world of direct physiology and biochemistry, this becomes more difficult. Josef-Binh Nguyen, PhD(TM), MD(TM), BASMRT, DipMgmt; Eric Yeoh, MD, FRCP(EDIN), FRCR, FRANZCR; and Sonya Stephens, DASN, DBA, GradCertClinTRes, provide us intriguing original research on "Human Universal Energy" to improve quality of life in women suffering breast cancer. I commend the authors for their efforts to design and implemeent a rigorous, statistically sound, controlled study. When reading the study, you will see the clear challenges of subjective measures and patient engagement complicating the analysis. Nonetheless, this type of research is an important early step in evaluating a nonconventional intervention

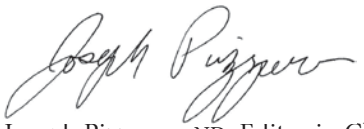
Jessica M. Pizano, DCN, CNS; Cathleen M. Burns, RD, LDN, DCN; Christy B. Williamson, CNS, DCN; Crystal M. Gossard, CNS, DCN; Keren E. Dolan, LDN, DCN; Heather J. Finley, DCN, RD, LD, CEDRD; Margaret G. Gasta, DCN, RDN, CCN; and Emily C. Parker, DCN, MS, RD, under the guidance of Elizabeth A. Lipski, PhD, CNS, CCN, BCHN, IFMCP, provide us part 9 of their comprehensive series on probiotics—this time for cancer care. This series is providing the definitive reference for clinicians wanting to know which probiotics have the strongest evidence for patient care in specific conditions.

I am excited and encouraged to see more naturopathic students being involved in research and want to congratulate Heather Zwickey, PhD, for her remarkable leadership. This case report by Adam Dombrowski, BS; Krista Imre, BA; Michelle Yan, BBM; Paul Kalnins, ND, MSOM, LAc; Laura Gouge, ND; Daniel Silver, MTCM, LAc; and Heather Zwickey, PhD, demonstrates the importance of comprehensive natural care in the treatment of osteoarthritis.

Managing editor, Craig Gustafson, provides us a second interview, this time of extraordinary integrative medicine leader, Mimi Guarneri, MD, who is president of Academy of Integrative Health & Medicine (AIHM). Her engagement with the Vatican on the effects of climate on health is quite remarkable and important.

In this issue, we initiate and celebrate a new relationship with AIHM. We are now publishing abstracts from posters presented at The Academy of Integrative Health & Medicine Annual Conference, which took place October 21-24, 2017, in San Diego, California. The abstracts cover "Caring for the Caregiver," "Massage Therapy in Orthopedics, "Intralesional *Viscum album* Extract," and "Anti-papilloma Virus Effects of *Sarracenia purperea*."

Associate editor, Bill Benda, MD, finishes the issue with his, as usual, pithy, uncomfortable BackTalk that makes us think. I have also noticed the deplorable and growing phenomenon of misuse of human kindness for personal benefit.



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