Environmental Causes of Infertility

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The evidence has increased dramatically over the past ten years demonstrating how infertility and miscarriage are frequently environmentally caused disorders. This fact offers encouragement to couples attempting to conceive since it strongly implies that lifestyle changes can greatly improve the likelihood of conception. The following report outlines the latest medical research pertaining to this topic – relevant statistics and suspected environmental causes of infertility and miscarriage. People wishing more information on any particular subject should acquire the complete article listed in the box to the right of the summary. Information was compiled by Richard Pressinger, (previously a graduate student at the College of Public Health, University of South Florida) and edited by Wayne Sinclair, M.D. (Board Certified Immunology).

Your odds of being infertile differ with age 15-24 years old……... 4.1% 25-34 years old…….. 13.1% 35-44 years old……. 21.4%	National Center for Health Statistics Redbook Magazine, August, 1993
The risk of miscarriage differs with age 20-29 years old……. 10% risk of miscarriage 45 or older……. 50% risk of miscarriage	Chatelaine Magazine November 1993, pg.26
Male infertility increases over past 40 years One-half of 1% of men were functionally sterile in 1938. Today it has reached between 8-12% (an over 15-fold increase). "Functionally sterile" is defined as sperm counts below 20 million per milliliter of semen.	Dr. Cecil Jacobson Reproductive Genetics Center Vienna, Virginia
Miscarriage more common with low sperm counts Women experiencing miscarriages typically had husbands with lower sperm counts and 48% "visually abnormal sperm." Men who fathered normal pregnancies had 25% higher sperm counts and only 5% visually abnormal sperm.	Drs. Mirjam Furuhjelm and Birgit Jonson Dept. of Obst. And Gyn., Sabbatsberg Hospital, Karolinska Institute, Stockholm Sweden International J. of Fertility, 7(1):17-21,1962
40% of all infertility cases are due to the male	Dr. Pat McShane Department of Obstetrics and Gynecology, Boston Massachusetts
Nationwide infertility rates A study by the National Center for Health Statistics estimated in 1988 that 8.4% of women 15-44 years had impaired ability to have children and about half of these couples eventually conceive. (These are overall average infertility figures – statistics will vary greatly depending on the age of the individual).	Dr. Howard Jones New England Journal of Medicine December 2, 1993, pg. 1710 Article entitled: "The Infertile Couple"
Fertility treatments not very effective Expensive fertility treatments resulted in only a 6 percentage point improvement in achieving pregnancy over "infertile" couples who just "kept trying." In a study of 1,145 couples who had been diagnosed as infertile, only half of them were treated to help attain pregnancy. After a two to seven year follow-up, pregnancies occurred in 41% of treated couples and 35% of the untreated couples.	Dr. John A. Collins Professor of Obstetrics/Gynecology McMaster University, Hamilton, Ontario New England Journal of Medicine November 17, 1983
More evidence that fertility treatments not effective Another study of 2,000 couples found "roughly the same" small improvements in achieving pregnancy when comparing couples who sought infertility treatments and those who kept trying.	Dr. John A. Collins Professor of Obstetrics/Gynecology McMaster University, Hamilton, Ontario Sterility Fertility Jornal, Fall Issue, 1993
Infertility treatments a $1 billion a year industry	Health Facts Vol. 19 (176), January, 1994

Lifestyle changes improve odds of conception "20% of all cases where the male is the only contributing factor to infertility can be corrected by lifestyle."	Dr. Wolfram Nolten Division of Endocrinology and Metabolism University of Wisconsin
Lower sperm count increases risk of miscarriage. The odds of having a miscarriage or child with birth defects rises dramatically when fathers have lower sperm counts. When the father's sperm counts were above 80 million they had only a 1% birth defect rate compared to 6% for the general population. Miscarriages were also lower for the fathers with higher sperm counts - 6% compared to 12% for the general population.	Dr. J.K. Sherman University of Arkansas study 1000 children whose mothers were artificially inseminated with sperm from men whose sperm counts were above 80 million per milliliter Washington Star, January 7, 1979
Smokers have lower sperm counts Smokers' sperm counts are, on average, 13-17% lower than non-smokers.	Dr. Marilyn F. Vine University of North Carolina Fertility Sterility Journal 6(1):35-43, 1994
Stopping smoking increases sperm counts A study of three smokers who were followed for 5-15 months after stopping smoking reported that their sperm counts rose 50-800%, suggesting that toxic chemicals in the smoke are responsible and any reduction in sperm count might be reversible.	Ibid.
Smokers have more abnormal sperm "*Male smokers have an increase in sperm abnormalities , thereby suggesting a mutagenic effect.*"	Quoted from the American J. of Epidemiology, 140(10):921-928, 1994. Original study was reported in the Lancet, 1:627-629, 1981
Cigarette consumption increases "Cigarette consumption in the U.S. has increased 3-4 fold from 1940 to the beginning of the 1980's."	Dr. R. J. Ravalet Population Develop. Reviews 16:213-240, 1990
Smokers face higher infertility 38% of female non-smokers conceived in their first cycle of attempting pregnancy compared to 28% of smokers. Smokers were also 3-4 times more likely than non-smokers to have taken greater than a year to conceive.	Dr. D. Baird National Institute of Environmental Health, N.C. JAMA, 253:2979-2983, 1985
Abnormally shaped sperm and decreased fertilization "A high number of abnormal sperm heads is associated with decreased fertilization. Some drugs such as sulphasalazine, used to treat inflammatory bowel disease can drastically reduce semen quality."	Dr. N. E. Skakkebaek University Department of Growth and Reproduction Lancet, June 11, 1994, p.1474
Pesticides suspected of causing infertility Men experiencing infertility were found to be employed in agricultural /pesticide related jobs 10 times more often than a control group of men not experiencing infertility. See related articles showing pesticides can damage sperm and testicles.	Dr. Hein Strokum Institute of Sterility Treatment, Vienna, Austria American Journal of Industrial Medicine, 24:587-592, 1983
Common pesticide reduces sperm count Lower sperm counts and obvious damage to the quality of the sperm producing part of the testicles (called the somniferous tubules) were found in test posed to the pesticide chlordane.	Drs. Khawla J. Balash, Muthanna A. Al-Omar University of Baghdad, Biological Research Center Scientific Research Council, Baghdad, Iraq Bulletin of Env. Cont. Toxicology, 39: 434-442, 1987
Most families live in pesticide contaminated homes Approximately 70% of current U.S. homes are being found to contain the pesticide chlordane (used previously as a termite treatment) in the breathable air. Of significant concern, 6-7% of all homes treated for termites have been found to have air levels of chlordane above the "safe" level of 5 micrograms per cubic meter. (In homes built before 1980, this is over 20%!).	Drs. Samuel S. Epstein, David Ozonoff School of Public Health University of Illinois Medical Center Boston University School of Public Health, Boston MA; Teratogenesis, Carcinogenesis and Mutagenesis Volume 7:527-540, 1987

Pesticide increases auto-immune problems The pesticide Chlorpyrifos (Dursban) was found to cause increases in autoimmune antibodies in people exposed to the pesticide. Autoantibodies are "renegade" immune system components which mistakenly attack the person's own self. (Please see other references in this report which link some cases of male and female infertility to autoimmune disorders in which the immune system cells attack either the sperm or the egg).	Drs. Jack D. Thraspher, Robverta Madison et.al. Department of Health Science California State University Archives of Environmental Health Vol. 48(2) 1993, March/April
Car exhaust decreases fertility The common car exhaust compound benzo(a)pyrene causes a significant reduction in fertility in test animals and fertility was further lowered when animals were exposed to both BaP and lead simultaneously. Results showed approximately a 33% reduction in ovarian weight and a "marked reduction in ovarian follicles"	Drs. P. Kristensen, Einar Eilertsen, et al. National Institute of Occupational Health, Norway Environmental Health Perspectives Vol. 103:588-590, 1995
Coffee decreases fertility A study of 1,909 women in Connecticut found the risk of not conceiving for 12 months (the usual definition of infertility), was - 55% higher in women drinking 1 cup of coffee per day 100% higher for women drinking 2-3 cups per day 176% higher for women drinking more than 3 cups per day	Hetah (1990) This study referenced by – Drs. Larry Dulgisz, Michael B.Brachs Yale University School of Medicine Epidemiologic Reviews, Vol. 14:83-, 1992
Coffee increases miscarriage risk Coffee drinking before and during pregnancy was associated with over twice the risk of miscarriage when the mother consumed 2-3 cups per day.	Dr. Claire Infante-Rivard Department of Occupational Health Faculty of Medicine McGill University , Quebec, Canada Journal of the American Medical Association December 22, 1993
Coffee reduces blood to the brain Coffee drinking caused a 20-25% reduction in blood flow to the brains of healthy test volunteers 30 minutes after drinking 250 milligrams (about the amount in a freshly brewed cup of coffee).	Dr. Roy J. Mathew Vanderbilt University, Nashville, Tennessee British Journal of Psychiatry, December, 1984
Spontaneous abortion after chemical exposure Spontaneous abortion increased over 4-fold for women once they became employed as microelectronics assembly workers. The job was found to subject women to a number of chemical solvents used in cleaning the electronic components including xylene, acetone, trichlorethylene, petroleum distillates and others, as well as solder vapors. (Acetone is also a common nail polish remover).	Drs. G. Huel, D. Mergler, R. Bowler Quebec Institute of Research in Occupational Health and Safety, University of Quebec, Canada Occupational Medicine Clinci, University of California, San Francisco, California British Journal of Industrial Medicine Vol. 47:400-404, 1990
Cocaine and abnormal offspring Cocaine exposure of males before conceiving is linked to abnormal development in offspring. The suspected cause is that cocaine binds onto the sperm and therefore, finds its way into the egg at fertilization.	Dr. Ricardo Yazigi Department of Obstetrics and Gynecology Washington University School of Medicine Journal of the American Medical Association (JAMA) Vol. 66(14), October 9, 1991
MSG lowers pregnancy rates MSG (Monosodium Glutamate), a common flavor enhancer added in foods, was found to cause infertility problems in test animals. Male rats fed MSG before mating had less than a 50% success rate (5 of 13 animals), whereas male rats not fed MSG had over a 92% success rate (12 0f 13 animals). Also the offspring of the MSG treated males shoed shorter body length, reduced testes weights and evidence of overweight at 25 days. MSG is found in the product "ACCENT," flavored potato chips, Doritos, Cheetos, meat seasonings and many packaged soups.	Drs. William J. Pizzi, June E. Barnhart, et. Al Department of Psychology Northeastern Illinois University, Chicago, Illinois Neurobehavioral Toxicology Vol. 2:1-4, 1979

Immune System problems found in infertility The rate of autoimmune antibodies (antibodies which mistakenly attack the person's own body) was reported to be 33% in women unable to deliver a baby to full term and 0% in a control group of women with successful pregnancies.	Dr. Eli Gea In Vitro Fertilization Unit Serlin Maternity Hospital Tel Aviv, Israel Fertility Sterility Journal, 62(4), October, 1994
Immune System problems also linked to miscarriages *"20-25% of miscarriages are due to immune system problems."*	Dr. Salim Daya The Fertility Clinic Chedoke-McMaster Hospital, Ontario Chatelaine Magazine, November, 1993
Miscarriage higher after chemical solvent exposure Two solvent chemicals exposed to working pregnant mothers making silicon chips had a 33% miscarriage rate. Normal miscarriage rate is 15%.	Time Magazine October 22, pg. 27, 1992
Male infertility and chemicals in drinking water Drinking water from Thames Water Supply in the United Kingdom was pinpointed as the cause of lower sperm counts and increases in abnormally shaped sperm. Common detergents were the chemicals suspected as causing the reproductive damage.	Dr. Jean Ginsburg London Royal Free Hospital Lancet, Jan. 22
Anesthesia linked to birth defects Birth defects occurred nearly 3 times more often in a study of 621 Michigan nurse anesthetists (a nurse who helps with anesthesia preparation). A total of 16.4% of the nurses practicing anesthesia during pregnancy had children with birth defects compared to only 5.7% of nurses not practicing anesthesia.	Drs. Thomas H. Corbett and Richard Cornell Assistant Professor, University of Michigan Anesthesiology, 41(4) 1974
Risks from medical fertility treatments A common treatment for infertility is administration of follicle stimulating hormones. Regarding this treatment, researchers stated, "Persistent stimulation of the ovary by gonadotropins may have a direct carcinogenic effect or an indirect effect attributable to raised concentration of estrogens."	Department of Obstetrics & Gynecology, Radbodnd University, Netherlands Lancet, April 17, 1993, pg. 987
Alcohol reduces fertilization success A 50% reduction in conception was found in experiments of test animals given "intoxicating" doses of alcohol 24 hours prior to mating	Dr. Theoodre J. Cicero Washington University of School of Medicine Science News, Vol. 146
IVF (in vitro fertilization) success rates A woman's age is main predictor of IVF success rates. Under 35 years…….. 45-50% success 35-40 years……..... 28-35% success age 41……..... 20% success 42 and older……..…. 3% success The cost of IVF can exceed $8,000. IVF is fertilization taking place in a "test tube" (or other apparatus) after removal of a woman's egg from the ovaries.	Dr. Rosenwaks New York Hospital Cornell Medical Center Redbook Magazine, August, 1993
Painters have more children with mental disorders Studies of painters found they are more likely to father children with defects of the central nervous system.	Dr. Andrew Olshan University of North Carolina, Chapel Hill U.S. News and World Report, December 14, 1992
Marijuana stops ovulation Marijuana use at "moderate" levels was found to stop ovulation in monkeys for 135 days. Researchers also stated that the THC in marijuana may be directly toxic to the developing egg. Dr. Carol Smith, the main researcher, stated, "*There are nervous pathways into the hypothalamus (a gland that regulates the reproductive cycle) that are being suppressed*." Dr. Smith also stressed that women who are attempting to conceive or who are pregnant should not use marijuana.	Dr. Carol Grace Smith University of the Health Sciences, Bethesda, Md. Ricardo Asch, University of Texas, Austin Science, March 25, 1983 Also reported in Science News, March 26, 1983

Sperm Damage linked to anesthesia: Sperm damage was about 50% higher in test posed to the anesthesia enflurane. Anesthesia levels given to the animals was equal to the level that would be given to humans.	Dr. Paul C. Land and E. L. Owen Department of Anesthesia, Northwestern University Medical School, Chicago, Illinois Anesthesiology, 54:53-56, 1981
Quotes for the Harvard Health Letter: *"8-10% of sperm from healthy men are abnormal, some carry the wrong chromosome while others have bits and pieces of genetic material out of place."* *"Because a child conceived by intoxicated parents was thought to be unhealthy, the ancient cities of Carthage and Sparta had laws prohibiting the use of alcohol by newlyweds."* *The earliest evidence of a link between job occupation and reproductive problems came in 1860 when a French scientist noted that wives of lead workers were less likely to become pregnant, and if they did, were more prone to miscarrying."* *"A survey of animal data indicates that paternal(father) exposure to environmental toxins, ranging from recreation drugs to industrial chemicals, apparently contribute to problems ranging from fetal loss and stillbirth to diminished aptitude for learning to perform tasks such as running a maze."*	Harvard Health Letter October, 1992
Other Points from the Harvard Health Letter: "*Men who work in aircraft industry or handle paints or chemical solvents are art higher risk of producing children with brain tumors.*" "*Father exposure to paints linked to childhood leukemias*." "*Firemen appear to produce an unusually high number of abnormal sperm and be less fertile than other males.*"	Ibid., p.6.
Miscarriages Warn of Genetic Damage 90% of fetuses with malformations are spontaneously aborted during early pregnancy. 60% of first trimester spontaneous abortions have chromosome abnormalities.	Dr. Frank Sullivan Department of Pharmacology and Toxicology University of London Environmental Health Perspectives 101(Suppl 2):13-18, 1993
Little is Known About Reproductive Dangers of Chemicals Regarding chemicals in the workplace, the Organization for Economic Cooperation and Development (OECD) and the European Economic Community (EEC) prepared lists of several thousand chemicals produced in amounts of more than 1000 tons per year and many produced at 10,000 tons per year: "*Toxicological data of any type exist for a few hundred and reproductive toxicology data exist for probably 100*."	Dr. Frank Sullivan Department of Pharmacology and Toxicology University of London 101(Suppl 2):13-18, 1993
Miscarriage Increases after exposure to Solvents. The major risk chemicals were: Perchlorethylene(dry cleaning) 4.7 times greater risk Trichlorehylene(dry cleaning) 3.1 times greater risk Paint thinners 2.1 times greater risk Paint strippers 2.1 times greater risk Glycol ethers(found in paints) 2.9 times greater risk	Dr. Gayle C. Windham, PhD Dr. Dennis Shusterman, MD, MPH School of Public Health University of California, Berkely American Journal of Industrial Medicine Vol. 20:241-259, 1991

Further evidence chemicals damage reproduction. Quotes from Dr. Baranski, Institute of Occupation Medicine, Denmark: "*Risk of infertility increased in females who reported exposures to textile dyes, dry cleaning chemicals, noise, lead, mercury, and cadmium*....There was a significant risk of increased time to conception among women exposed to anti-rust agents, welding, plastic manufacturing, lead , mercury, cadmium, or anesthetic agents." "There was, also, an increased risk of delay to conception following male exposure to textile dyes, plastic manufacturing, and welding. Those who unpacked or handled antibiotics had a significant association with delayed pregnancy of at least 12 months."	Dr. Boguslaw Baranski Institute of Occupational Medicine Copenhagen, Denmark Conference on the Impact on the Environment and Reproductive Health , September, 4,1991 Environmental Health Perspectives, vol. 101(Suppl 2), p.85, 1993
Reasons for female Infertility: Tubal Factors 36% Ovulatory Factors 33% Endometriosis 6% No Known Cause 40%	Dr. David Lindsay Department of Obstetrics and Gynecology Monash University, Melbourne, Australia Lancet, June 18. 1994
Chromosomal abnormalities occur in 26% of human oocytes (eggs) and 10% of sperm	Ibid.
Miscarriage linked to chromosome abnormalities Recurrent miscarriage is associated with parental chromosome abnormalities, anti-phospholipid antibodies and uterine cavity abnormalities. Premature ovarian failure(inability of ovaries to produce eggs) may be genetically determined or associated with autoimmune disease."	Ibid.
Birth defects tied to jobs and chemicals Stillbirth, Preterm Delivery and small Birth Weight were higher in certain jobs with chemical exposures in a study of 2,096 mothers and 3,170 fathers. Women working in rubber, plastics or synthetics industry had an 80% greater chance of stillbirth. Father's employment in the textile industry (chemical dyes, plastics, formaldehyde, etc.) resulted in their wives having a 90% greater chance of stillbirth. Exposure of the father to the chemicals polyvinyl, alcohol, and benzene(found in gasoline, cleaning solvents, adhesives, and oil based paints was associated with a 50% increase in preterm delivery.	Drs. David A. Savitz, Elizabeth A. Whelan and Robert C. Kleckner School of Public Health University of North Carolina Study funded by the March of Dimes American Journal of Epidemiology Volume 129(6):1201-1218, 1989
Chemical found to mimic human estrogens A proper balance of natural estrogens in the body is essential for the reproductive process. However, reports have suggested that environmental estrogens (chemicals which mimic our natural estrogens) are creating infertility problems by confusing the body's estrogen receptors. Some pesticides have already been shown to be environmental estrogens. New research shows that more chemicals are being found to be environmental estrogens including the food additive butylated hydroxyanisole (BHA). Other chemicals found to be somewhat estrogenic include a variety of plastics, including PVC.	Drs. Susan Jobling, Tracey Reynolds, Roger White, Malcolm Parker, and John Sumpter Department of Biology and Biochemistry Laboratory of Molecular Endocrinology Brunel University, London Environmental Health Perspectives Vol. 103:582-587, 1995

Cosmetics in Pregnancy

Links to Miscarriage, Learning Disabilities and Behavior Disorders

INTRODUCTION

The following introduction is from the Department of Epidemiology, School of Public Health, University of North Carolina (1).

> *"Cosmetology, a predominantly female occupation comprising over half a million women in the United States, has received little attention with regard to potential adverse reproductive outcomes. Cosmetologists (also called hairdressers, stylists, or beauticians) have daily contact with cosmetic products and thus are routinely exposed through inhalation or skin absorption to a wide range of chemicals, including established toxins such as dyes and solvents, and they generally perform their work in a standing position. Exposure to chemicals during pregnancy has been associated with increased spontaneous abortion risk in various occupations."*

Concern for cosmetic products should also carry over to all women as chemical based hair dyes, hair sprays, facial make-ups and finger nail polish are routinely used by the majority of American women. Many of these chemicals were stated as being mutagenic (having the ability to damage the genes and chromosomes) in a paper by the Toxic Chemicals Laboratory, New York State College (2)

As several research articles have found increased genetic abnormalities occurring in pregnancies resulting in spontaneous abortion, the following investigation of women working around the chemicals used in cosmetics raises serious concern.

Spontaneous Abortions Higher Among Cosmetologists

Working in the cosmetics industry increases the chance of having a pregnancy end in spontaneous abortion. This was the conclusion of a research study partially funded by the March of Dimes Foundation and conducted at the University of North Carolina School of Public Health. Researchers investigated over 1,000 live births and spontaneous abortions among cosmetologists and other occupations, including comparison to women who stayed at home. Results showed that women employed full-time as cosmetologists (35 or more hours per week) had a higher rate of spontaneous abortion than women in other jobs. The researchers analyzed different working exposures for the cosmetologists in an attempt to identify which cosmetology practices were more dangerous. The table below lists different cosmetology working conditions and the corresponding increased risk of having a spontaneous abortion.

COSMETOLOGY WORK PRACTICES AND INCREASED SPONTANEOUS ABORTIONS

Survey Of 1,249 Births And Spontaneous Abortions

Cosmetic Practice	***Risk of Spontaneous Abortion***
Working In Cosmetology School	2.3 times greater risk
Working in Cosmetic Business 35-40 Hours Week	1.2 times greater risk
Working in Cosmetic Business More than 41 Hours Wk	2.0 times greater risk
Performing more than 13 Chemical Services per Week	1.9 times greater risk
Giving 10 or more Permanents Per Week	1.9 times greater risk
Performing more than 2 Bleaches Per Week	1.9 times greater risk
Use of Formaldehyde Based Disinfectants	2.0 times greater risk
Working Around Employees Performing Nail Sculpturing	1.9 times greater risk
For Comparison - Working at Home "Homemaker"	.1 times decreased risk

In summary, the researchers stated,

> *"To our knowledge, this is the first study to examine the relation between specific occupational exposures in cosmetology and the risk of spontaneous abortion.... Since cosmetology involves exposure to chemical mixtures from multiple sources, it is difficult, if not impossible, to identify effects associated with specific chemical agents. We found that several work characteristics were independently associated with an increased risk of spontaneous abortion, including the number of chemical services performed per week, the use of formaldehyde-based disinfectants, and work in salons... Women who attended cosmetology school during the first trimester of pregnancy had more than double the risk of a spontaneous abortion... Among our relatively young respondents to the screening questionnaire, spontaneous abortions accounted for 7.8% of the most recent pregnancies... Future research based on larger study populations, improved assessment of occupational exposures, and validated reproductive outcomes is warranted to replicate our findings and identify any specific reproductive hazards in cosmetology."*

Epidemiology, 5(4):147-155, *Spontaneous Abortions among Cosmetologists*, Esther M. John, David A. Savitz, and Carl M. Shy, Department of Epidemiology, School of Public Health, University of North Carolina

References

1) **Epidemiology, 5(4):147-155**, *Spontaneous Abortions among Cosmetologists*, Esther M. John, David A. Savitz, and Carl M. Shy, Department of Epidemiology, School of Public Health, University of North Carolina
2) **Journal of Toxicology and Environmental Health, 34:197-206, 1991**, *Urinary Mutagens in Cosmetologists and Dental Personnel.*

Alcohol & Marijuana Together Cause Dramatic Reductions in Fertility

Women who combine the use of alcohol and marijuana may greatly reduce their chance of conceiving. In a study at the Research Institute on Alcoholism, Buffalo, New York, Dr. Ernest L. Abel tested the hypothesis that alcohol in combination with marijuana would decrease fertility far more than if either drug was used alone. Using both rats and mice, Dr. Abel exposed 85 of the animals to either alcohol or marijuana, or alcohol plus marijuana, along with a control group that was not exposed. Exposure levels of the drug were determined from previous research as the maximum level that did not cause any reproductive problems.

The results showed that neither alcohol nor marijuana used alone caused any significant increases in resorptions or fetal deaths, however, when alcohol and marijuana were used in combination, there was a 73% fetal mortality (offspring deaths) in the rats and 100% fetomortality in the mice.

Dr. Ernest L. Abel
Research Institute on Alcoholism, Buffalo, New York
Teratology 31:35-40 (1985)

MSG Increases Odds of Infertility and Obesity - Shorter Growth

To investigate the possibility of long term effects from MSG ingestion, 38 healthy animals were tested from birth to nine months of age. Twenty animals received injections of MSG daily from 1 to 10 days after birth, 18 control animals received no MSG.

The results showed MSG treated animals appeared stunted in growth and still remained shorter than controls on day 30. Of significant interest, animals treated with MSG continued to gain weight on unrestricted diets beyond the age of 5 months. Average weights of the 5 month old animals were 37 grams for the non-MSG treated and 57 grams for the MSG treated animals. Contrary to expectation, the "obese" MSG treated animals actually consumed less food than their thinner control counterparts, implying the overweight was due to damage to the brain area responsible for controlling body weight. Mean per capita food consumption over the daily 4 hour measuring period was 2.5 grams for the controls and 1.7 grams for the MSG treated animals.

Also noted at 5 months, the MSG animals were lethargic as adults and lacked the sleekness of body coat seen in the controls. The reproductive capacity of the MSG females was also reduced in that they repeatedly failed to conceive in spite of adequate exposure from 5 to 9 months of age.

In summary, Dr. Olney writes,

> *"These observations, linking MSG treatment of the neonatal mouse with a syndrome of manifestations, including skeletal stunting, marked adiposity, and sterility of the female, coupled with histopathological findings in several organs associated with endocrine function, suggest a complex endocrine disturbance. In view of the additional finding of lesions in regions of the brain thought to function as neuroendocrine regulatory centers, a unitary hypothesis might be constructed relating all or most of the findings to the neonatal disruptions of neuronal development in these centers.... The assumption that MSG is an entirely innocuous substance for human consumption has been questioned recently in view of its role in the Chinese Restaurant syndrome. The finding that neuronal necrosis can be induced in the immature mouse brain by 0.5 mg/kg of MSG raises the more specific question whether there is any risk to the developing human nervous system by maternal use of MSG during pregnancy. The primate placenta maintains amino acids in consistently higher concentrations in the fetal circulation than those found in the maternal circulation, the ratio of glutamic acid being grater than 2:1. In fact, when high doses of phenylalanine were given to a pregnant rhesus monkey, the ratio of mother to fetus for this amino acid remained unchanged so that exceedingly high fetal blood levels resulted. The possibility that brain lesions could occur in the developing primate embryo in response to increased glutamic acid concentrations in the maternal circulation, therefore, warrants investigation."*

Dr. John W. Olney
Department of Psychiatry, Washington University School Medicine, St. Louis, Missouri
SCIENCE 164:719-721 (1969)

Pesticides Mimic Human Hormones Damage Reproductive System

Pesticides and other chemicals are being found to resemble the hormone estrogen, thereby creating serious problems for the reproductive system, according to research by Dr. Richard M. Sharpe of the University of Edinburgh and Dr. Niels Skakkebaek of the University of Copenhagen. The substances that concern the researchers most include DDT, PCB's, dioxins, and some petroleum by-products.

Sperm count, according to Skakkebaek, has taken a "nose-dive" during the past half century. They looked at 61 papers on male fertility published between 1938 and 1990, covering data on almost 15,000 men from around the world. According to Skakkebaek and his Danish colleagues, the mean sperm count had declined from 113 million per milliliter in 1940 to only 66 million per milliliter in 1990. Moreover, the volume of semen in a single ejaculation had also fallen from 3.40 to 2.75 milliliters. Those figures suggest that, on average, men now produce less than half as many sperm as did men 50 years ago.

Chemicals with affinities for estrogen receptors on cells could cause these problems, state the researchers. Animal studies have shown that if male fetuses are exposed to high doses of estrogens, they may develop with many female characteristics. Lower doses may alter the differentiation and multiplication of the germ cells that eventually give rise to sperm, the researchers note.

Dr. John A McLachlan, director of intramural research at the National Institute of Environmental Health Sciences states, "*some of the environmental chemicals that have estrogenic activity also seem to have a long half-life and can bioaccumulate*" in the body's fat. One group, he explains, looked at the effects of the insecticide kepone that is only weakly estrogenic. At first, female rats exposed to part-per -billion levels of kepone showed no effects, but after about nine weeks of exposure the chemical reached potent levels, and the animals' reproductive systems locked into a perpetual ovulatory state. The World Wildlife Fund has gathered evidence that some seagulls, fish and other creatures in polluted areas exhibit abnormal reproductive behavior or physiology.

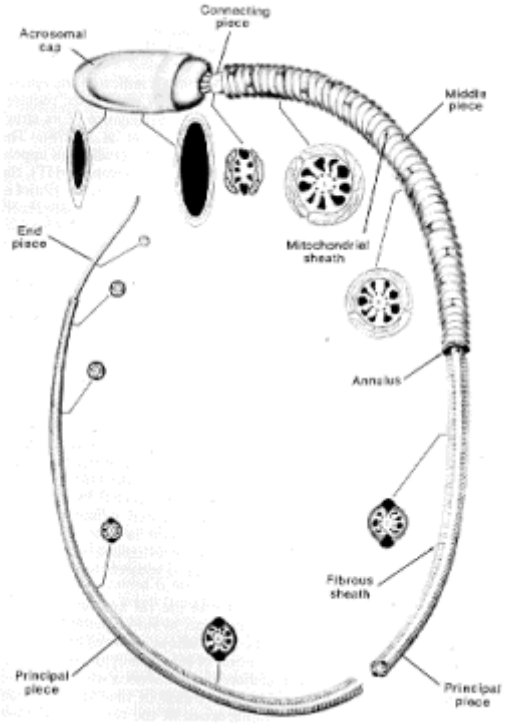
Malignant Mimicry
Scientific American, September Issue, 1993

Sperm Damage & Environment

INTRODUCTION

The past ten years has shown an increase in studies linking weak or defective sperm to employment in occupations with exposure to chemicals and pesticides (American Journal of Industrial Medicine 24:587-592, 1993). Weak or defective sperm are giving evidence of having an increased risk for problems with pregnancy and the offspring. In a statement from researchers Dr. Hemavathi and Dr. Rahiman of the Department of Biosciences, Mangalore University, India (4),

"An elevated level of abnormal sperm is an indication of the mutagenic potency (ability to damage the genetic code) of the test chemical. When treated with a mutagen during spermatogenesis (during sperm development), mice show increased frequency of abnormally shaped sperm heads."



The above drawing details various parts of a normal sperm. The sperm head (called an acrosome) is located at the top and houses the genes on the DNA molecule. Deformities in the acrosome head are being found to occur more often after chemical exposure, cited several times in this section.

As an example of this observation, Dr. Hemavathi subjected mice to levels of three common pesticides - ziram, thiram and dithane M-45 in order to observe effects upon the animals' sperm. Doses were given daily for five days at one-fourth that which is known to kill 50% of the animals. Results showed all the pesticides caused over a 3 to 8-fold increase in sperm abnormalities such as double heads, small heads, elongated heads, large heads, double tails, coiled sperm, and acrosomes bent upward or downward and some sperm without acrosomes.

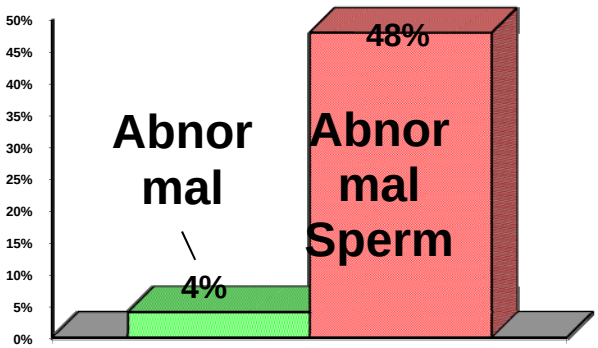
Understanding of the sequence for male sperm production helps understand the vulnerability of the sperm to environmental/chemical exposures. One common public misunderstanding is that the male manufactures millions of sperm daily, so therefore, activities engaged in weeks or months earlier would then not have an effect upon the sperm quality. This assumption is actually incorrect. Although it is accurate that the human male produces millions of sperm daily, it is important to realize that it takes 64 days to actually create the sperm within the testicles. So therefore, there is over two months worth of time before conception that the male can be exposed to environmental circumstances that could slow or harm the healthy genetic development of the sperm cell.

It is now generally accepted that the U.S. male population has shown a large decrease in sperm counts since the 1930's and 40's. This in itself does not generate too much concern since conception can occur even with low sperm counts. However, what should generate significant concern is the fact that research reported by several investigators has shown in several species of animals that as sperm count lowers, there is a corresponding increase in the frequency of abnormal pregnancies, such as miscarriages or birth defects (5,6). Combining the information from both of these investigators then suggests that serious consequences

could already be appearing due to the continued decline in male sperm counts occurring in the U.S. and other industrialized nations.

Miscarriages Linked to Defective Sperm and Lower Sperm Counts

Pregnancies ending in miscarriage were found to have fathers whose sperm showed increased numbers of defective sperm as well as lower sperm counts. This was the conclusion in a 1962 research project conducted by the Department of Obstetrics and Gynecology at the Sabbatsberg Hospital in Stockholm, Sweden. Semen specimens were gathered from 201 men whose wives had experienced miscarriages in the second to third month of pregnancy or spontaneous abortions in the fourth to fifth month of pregnancy. Over half the research families had experienced two or more miscarriages. For comparison, sperm samples were taken from a control group of 116 husbands who had visited the hospital but whose wives had produced living normal children within two years. To insure similar parameters among participants, sperm samples were acquired by ion after an abstinence period of five days. Results of the two groups showed that sperm counts for the miscarriage/spontaneous abortion group was 110.2 million per cubic centimeter, while the sperm counts for the fathers of successful pregnancies was 138.7 million per cubic centimeter. The investigators classified this as "*highly significant statistically*." Of even more concern, it was found through microscopic examination of sperm samples that approximately 48% of the sperm were "abnormal" in the unsuccessful pregnancies while only 4% of the sperm were "abnormal" in the men who produced normal children.



Pregnancies ending in miscarriage are being found to be fathered by men with higher numbers of abnormal sperm (i.e. misshapen sperm heads, double tails, etc.). Abnormal sperm are also being found to occur more often in males exposed to chemicals during the two month sperm development period before conception.

In summary, the researchers stated,

> "*In the group of abortions* (unsuccessful pregnancies) *there was a highly significant increase in the percentage of abnormal spermatozoa as well as a highly significant decrease in the absolute number of normal spermatozoa. The conclusion is reached that defective semen may be an important factor in the etiology of abortions.*"

Drs. Mirjam Furuhjelm, Birgit Jonson, and C. Lagergren
Dept. of Obstetrics and Gynecology, Sabbatsberg Hospital, Karolinska Institute, Stockholm, Sweden
International Journal of Fertility, 7(1):17-21, 1962

Sperm Counts Decline Since 1940's - Testicle Abnormalities Increase

Several biological problems affecting the male testicles have been occurring with greater frequency over the past 50 years. The summary of the problem, which appeared in the 1993 journal, Environmental Health Perspectives, discussed the observed rise in testicular cancer and the medical conditions hypospadias and cryptorchidism, as well as the apparent declining sperm count among the overall male population. Hypospadias is when the testicles do not descend and cryptorchidism is where the opening to the penis appears on the underside of the penis.

According to the researchers at the Statistical Research Unit, University of Copenhagen, Denmark, cancer of the male testicles has increased over 3 fold from 1940 to 1980. The frequency of hypospadias (the opening of the penis is on the underside) in England has doubled from 0.15% in 1964 to 0.36% in 1983. Similar increases were also reported from Sweden and Hungary. Recent British data also detected a near doubling of cryptorchidism, in which the testicles failed to descend. This problem has risen from 1.6% of the boys born in the 1950's to 2.9% born in the late 1970's.

The researchers also performed a detailed survey of the international literature on sperm and semen levels published between 1930 and 1991. Compiling information from over 61 papers and 14,947 males indicated a significant decline in average sperm density form 113 million per milliliter in 1940 to 66 million per milliliter in 1990. The mean semen volume also declined from 3.40 milliliters to 2.75 milliliters (a nearly 20% drop). This means that the total sperm count decreased even more than that expressed by sperm density.

In other words, men are producing only about half as much sperm per ejaculation today as they did in the 1940's. This should generate concern as studies in this paper demonstrate that as sperm count decreases, there is an increase in risk of birth defects, miscarriages and general problems with the child. Therefore, these figures suggest that we should be observing a greater number of health and neurological problems among our children due to the connection between lower sperm count and lower sperm quality resulting from exposure of the male population to widespread environmental chemicals.

In conclusion the researchers stated,

> *"Recent data clearly indicate that the semen quality has markedly decreased during the period 1938-1990, and concomitantly the incidence of some genitourinary abnormalities including hypospadias, maldescent, and cancer has increased. Such a remarkable increment in the occurrence of gonadal abnormalities over a relatively short period of time is more likely to be due to environmental rather than genetic factors. Generally, it is believed that pollution, smoking, alcohol, and sexually transmitted diseases play a role."*

Aleksander Giwercman, Elisabeth Carlsen, Niels Keiding, and Niels E. Skakkebaek
University Department of Growth and Reproduction, University of Copenhagen, Denmark
Environmental Health Perspectives Supplements 101(2):65-71, 1993

Abnormal Sperm More Common for Men Living in Polluted Cities

Men who live in industrial cities (and therefore, exposed to more chemical pollution), were found to have 6 times more abnormal sperm than men living in a relatively clean rural town. The sperm of twenty semen donors living in the heavily polluted industrial city of Ludhiana, India were compared to 40 semen donors from the relatively clean town of Chandigarh, India. The researchers placed sperm samples on a microscope slide and counted the number of sperm with abnormal acrosomes (the acrosomes are the sperm heads which house the genetic code for the offspring). The percentage of abnormal acrosomes (double heads, elongated/misshapen heads) were 5% for men living in the non-polluted town of Chandigarh and 30% for men living in the polluted city of Ladhiana. The researchers also found the citric acid levels in the semen were about 50% less in the men living in the polluted city.

Dr. Sarbjit Kaur
Department of Zoology, Punjab Agricultural University, Ludhiana-141 004, Punjab, India
Bulletin of Environmental Contamination Toxicology, 40:102-104, 1988

Pesticide Causes Testicle Damage and Reduced Sperm Counts

As reports of infertility among pesticide workers are increasing (3), researchers at Kyushu University, Japan investigated the effects of the nematode pesticide DBCP (dibromochloropropane) and several related industrial chemicals called DC1P (dichoro-1-propanol) and DC2P (dichloro-2-propanol) along with the metabolites of these chemicals (metabolites are the new compounds resulting after the liver metabolizes the original compound). The metabolites investigated were ACH (alpha-chlorohydrin) and ECH (epichlorohydrin).

To investigate the effects of these chemicals upon the male reproductive system, the investigators created 6 groups of rats with 8-9 rats in each group. At 5 weeks of age, each group was given a single injection of one of the above chemicals at a dose well below that which would kill the animal. Six weeks after the injection the rats were sacrificed and sperm samples were taken from each rat. The sperm sample was then examined to determine sperm count along with the number of sperm with immature heads, abnormally shaped heads and sperm with no tails. Results showed that sperm counts were significantly reduced in the DC1P and DC2P group and posed to the pesticide DBCP showed a drastic reduction in sperm counts in comparison to the normal controls. The posed to the ACH metabolite also showed a slight but significantly reduced sperm count. Regarding the morphology (shape) of the sperm, there were not significant differences among any of the groups except a drastic increase in sperm without tails in the DBCP group. Whereas, there were only 14 per 1000 sperm with missing tails in the control group, there were 865 per 1000 sperm with missing tails in the DBCP exposed animals. Such a dramatic paralysis to sperm certainly explains the resulting infertility from these chemicals.

NORMAL SPERM DEVELOPMENT
Showing normal appearance above, sperm development occurs in these seminiferous tubules. Beginning their growth in the outer part of the seminiferous tubule, they spend 64 days maturing as they work their way toward the center in humans.

PESTICIDE DAMAGED SPERM
The damage to these sperm producing seminiferous tubules is easily seen after exposure to the pesticide DBCP. Greatly reduced diameter and few sperm are seen within the tubule in comparison to normal seminiferous tubules in photograph at left. The consequences to fertility are obvious.

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Department of Hygiene, Faculty of Medicine, Kyushu University, Fukuoka 812, Japan
Bulletin of Environmental Contamination Toxicology, 55:1-7, 1995

Common Pesticide Chlordane Damages Sperm Production

Chlordane was a pesticide used in nearly all U.S. homes built before 1988 as a wood treatment to either prevent or eradicate termites. It was finally banned in 1988 because of research showing it was entering the air of treated homes and links to health problems. Several different studies testing homes treated years earlier with chlordane have found the chemical in the breathable air in approximately 75% of homes and above the safety levels recommended by the National Academy of Sciences in 6-7% of homes tested (7).

Because of the widespread contamination of this chemical in American living (the chemical emits vapors for decades after treatment) and its link with causing abnormalities in blood and childhood blood and brain cancer, Dr. David Ozonoff, of the Boston School of Public Health, stated there is an "urgent need for legislation creating a national program for monitoring homes known to have been treated to detect persistent contamination with these highly dangerous pesticides (7)."

In the following study, researchers divided mice into three groups of ten mice each. Two groups were subjected to either a low or higher level of chlordane and the third group was used as a control group not exposed to any chlordane. After 30 days of daily exposure, the animals were sacrificed and the testicles were examined. The researchers stated that the chlordane exposed groups showed obvious changes to the part of the testicles where sperm development occurs (called the seminiferous tubules). Damaged tubules were present in 19% of the lower chlordane exposed animals - 31% of the higher chlordane exposed animals and only 3% in the animals not exposed to chlordane. There was also a reduction in the seminiferous tubule diameter in the higher chlordane exposed group.

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Dr. K. J. Balash, M. A. Al-Omar, et al.
Biological Research Center,
Scientific Research Council, Baghdad, Iraq
Bulletin of Environmental Contamination Toxicology, 39:434-442, 1987

Development Delays in Offspring of Chemotherapy Exposed Males

Adult rats exposed to the common cancer chemotherapy drug cyclophosphamide produced offspring that showed retardation in various tests of behavior development. The study, conducted by several colleges including the Division of Environmental Toxicology at the University of Texas Medical Branch, conducted behavioral assessments of the offspring using the following procedures.

Surface Righting	The time required for the animal to right itself when placed on its back.
Cliff Avoidance	The time it takes for the animal to move away from the edge of an elevated horizontal surface.
Swimming Capability	Determines how well the animal can swim using such criteria as how well they swim in a straight line, how much of the rat pup's head is above the water when swimming and how well they used their limbs when swimming.
Negative Geotaxis Test	The time it takes for the rat pups to reorient to a head-up position after being placed in a head-downward position on a 25 degree inclined plane.
Open Field Activity Test	Determining hyperactivity by measuring the total entries made on a 45 cm circular field which was divided into 24 components.

The rats were injected with the chemical for 5 days, allowed to rest for the next 2 days and then treated again for a period of 5 weeks. Beginning 3 days after the last injection, the animals were housed in cages with a ratio of two females to one male per cage for about 2 weeks.

Results of the study showed that there was no significant difference in surface righting ability in the exposed and not exposed rats. However, cliff avoidance was significantly slower for rats whose fathers were exposed to the cancer drug before conception. Swimming ability was also more difficult for the rats whose fathers were exposed to cyclophosphamide. They showed a greater number of offspring who swam with their heads lower in the water. Regarding the swimming direction of the animals, 10% of the non-exposed offspring swam in circles at 10 days of age, whereas over 40% of the exposed offspring swam in circles at 10 days of age. No difference was seen in both groups with the negative geotaxis test. Evidence of hyperactivity was seen in the open-field testing at the age of 14 and 21 days after birth and was considered significant.

In conclusion, the researchers stated,

> "Our data suggest that the behavioral effects measured during the preweaning period of the F1 progeny of the CP (cyclophosphamide) treated rats were consistent in that the same animals that appeared developmentally retarded in the cliff avoidance tests were also retarded in the swimming tests. That CP induced a genetically toxic effect is supported by (I) the time interval of 14 days, which involved a period of 3 days of rest after treatment and 11 days before conception of the first litter in the treated group and (ii) the short half-life of cytoxan in rodents and in man; half of the cytoxan is eliminated within hours after cessation of long-term systemic treatment. These data suggest that behavior testing of the F1 generation might be used as an endpoint to detect abnormalities induced during spermatogenesis and transmitted through the sperm. This end point would then be used to evaluate genetically transmissible effects of potentially mutagenic, carcinogenic, or teratogenic compounds. Further studies will determine if the observed differences are transient or permanent in nature. In either case, however, the procedures used in this report indicate a transmissible effect which can be used to detect genetically toxic compounds."`

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Department of Psychiatry and Behavior Sciences and Department of Pharmacology and Toxicology
University of Texas Medical Branch, Galveston, Texas
SCIENCE, Vol. 211(2), January, 1981

Animals Exposed To Anesthesia Show Abnormal Sperm Development

Spontaneous abortions and having a child with congenital birth defects has been found to be more common among people who work in operating rooms (7-9). In order to see if anesthesia was capable of causing sperm damage, Dr. Paul Land and his colleagues exposed 90 mice to different anesthesias and at levels expected in humans. Although there was not a significant increase in abnormalities in sperm for mice exposed to nitrous oxide, methoxyflurane, halothane or isoflurane, there were was approximately a 50% to over 100% increase in abnormal sperm for mice exposed to trichloroethylene, chloroform and the common anesthesia enflurane. When repeating the study, the researchers found the same results again. It should be noted that there were increases of about 20% for the common anesthesia isoflurane, but did not quite reach statistical significance.

Dr. Paul C. Land, E. L. Owen and Harry W. Linde (Ph.D.)
Department of Anesthesia, Northwestern University Medical School, Chicago, Illinois
Anesthesiology, 54:53-56, 1981

Infertility More Common in Agricultural Workers

Men working in the agriculture industry were showing up at infertility clinics ten times more often than what should have been expected. Investigating their "suspicions" after treating infertile couples, physicians at the Institute of Sterility in Vienna, Austria compared 103 consecutive couples who had sought artificial insemination with donor sperm (abbreviated as AID) and compared their job occupations with 103 couples who had sought help due to female fertility problems. The researchers reported that the patients medical histories showed no indications that diseases, long-term medication use, or cigarette smoking was related to male infertility.

In explaining their observations the investigators stated,

> *"In the last few years, there has been an ever increasing amount of discussion about the influence of the environment on man. The long-term side effects of environmental toxins on human reproduction has been a central issue in these discussions. Inspired by this, we began an investigation into the relationship between exposure to toxic substances e.g. chlorinated hydrocarbons used in agriculture and proven male sub- and infertility. What was particularly noteworthy was that the concentrations of some environmental toxins were generally clearly higher in those semen specimens which did not lead to fertilization as opposed to those specimens from which a pregnancy resulted (Feichtinger et al., 1986, Feichtinger, 1991). These results were not surprising as other authors had already shown a definite detrimental effect on male fertility in subjects exposed above average, e.g. workers in a pesticide producing factory (Whorton and Meyer, 1984). With experience in infertility treatment and especially after intensive involvement with AID, it struck us that there was a conspicuously high prevalence of couples with agricultural backgrounds. The indications for their referral to our clinic for AID was poor sperm quality or azoospermia (no sperm in the semen). The present has unequivocally confirmed this observation, the number of farmers being remarkably higher in the group seeking AID than in the control group within the same time period. This conspicuously high prevalence can probably be explained by the increased exposure to chemical sprays about which we inquired by questionnaire.... These toxic chemicals probably have a detrimental effect on male fertility and therefore we suggest more caution in the way they are handled."*

Dr. H. Strohmer, MD, Andrea Boldizsar, MD, Barbara Plockinger, MD
Institute of Sterility Treatment, Vienna, Austria.
American Journal of Industrial Medicine, 24:587-592, 1993

Sperm Count Drop Suspected from Chlorine Based Chemicals

Pesticides and other chemicals are being found to resemble the hormone estrogen, thereby creating serious problems for the reproductive system, according to research by Dr. Richard M. Sharpe of the University of Edinburgh and Dr. Niels Skakkebaek of the University of Copenhagen. The substances that concern the researchers most include DDT, PCB's, dioxins, and some petroleum by-products.

Sperm count, according to Skakkebaek, has taken a "nose-dive" during the past half century. They looked at 61 papers on male fertility published between 1938 and 1990, covering data on almost 15,000 men from around the world. According to Skakkebaek and his Danish colleagues, the mean sperm count had declined from 113 million per milliliter in 1940 to only 66 million per milliliter in 1990. Moreover, the volume of semen in a single ejaculation had also fallen from 3.40 to 2.75 milliliters. Those figures suggest that, on average, men now produce less than half as many sperm as did men 50 years ago.

Chemicals with affinities for estrogen receptors on cells could cause these problems, state the researchers. Animal studies have shown that if male fetuses are exposed to high doses of estrogens, they may develop with many female characteristics. Lower doses may alter the differentiation and multiplication of the germ cells that eventually give rise to sperm, the researchers note.

Dr. John A. McLachlan, director of intramural research at the National Institute of Environmental Health Sciences states, "some of the environmental chemicals that have estrogenic activity also seem to have a long half-life and can bioaccumulate" in the body's fat. One group, he explains, looked at the effects of the insecticide kepone that is only weakly estrogenic. At first, female rats exposed to parts per billion levels of kepone showed no effects, but after about nine weeks of exposure the chemical reached potent levels, and the animals' reproductive systems locked into a perpetual ovulatory state. The World Wildlife Fund has gathered evidence that some seagulls, fish and other creatures in polluted areas exhibit abnormal reproductive behavior or physiology.

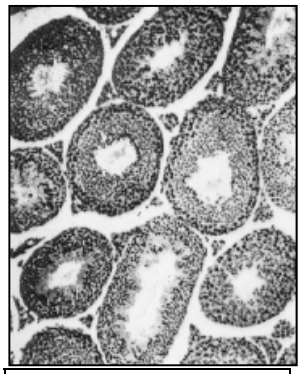
Malignant Mimicry
Scientific American, September, 1993

Surprising Sperm Abnormalities Linked to Chemically Grown Foods

This article certainly provides a good reason to switch away from the chemically grown commerical foods and stock up on those grown organically. (Organically grown food are grown using only natural fertilizers such as rock powders and marine by-products while commercially grown foods use chemical based fertilizers and pesticides).

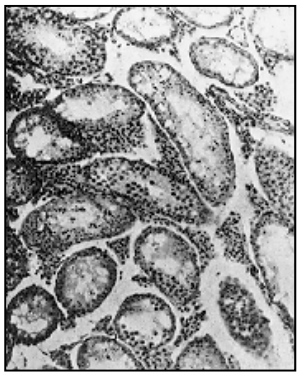
The following study was conducted in the late 1950's when farming was making its switch away from naturally growing methods to the now common chemical fertilizer/pesticide growing methods, investigators were concerned of the effects such foods might have on human health. To study the effect chemically grown foods would have on general health and the reproductive system, researchers at the Royal Free Hospital School of Medicine in London conducted an experiment in which 3 groups of 17 pairs of mice were fed wheat that was grown using either one of the following three different methods:

Group 1 - Chemical Fertilizers Alone (called "stockless")
Group 2 - Chemical Fertilizers & Manure (called "mixed")
Group 3 – No Chemical Fertilizers or Pesticiedes - only "composted fertilizers" (called "organic")



Organically Grown Sperm
The seminiferous tubules above are well shaped and full of sperm in mice who consumed organically grown wheat during the experiment.

After 14 weeks on their respective diets, the researchers found there was a very large difference in the microscopically observed quality of the testes of the male rats (see pictures). Of rats eating the chemically grown "stockless" wheat - only 11% had normal structure. Of rats eating wheat grown using "mixed" or "organic" farming methods - 48% had normal structure. Although sperm counts were not taken, the photograph at right shows a drastic reduction in total sperm in the epididymis (the part of the testicle that is a reservoir for mature sperm). The researchers stated that wheat in itself is not the best food for mice, but the results do show that "*reproductive performance was a sensitive indicator of differences between diets which had hardly shown significant differences in comparative growth tests*."



Chemically Grown Sperm
The seminiferous tubules above are smaller and lacking sperm in mice who consumed wheat grown on soil using only chemical fertilizers.

Certainly with the increases in infertility and abnormal sperm being observed in today's male population, this older research study highlights the significant benefits of which may be attained by consuming organic food for couples wishing to have children. Also, because of the potential to affect such a large poppulation, this study demonstrates the importance of conducting further research into health effects, not only regarding fertility, but also in general genetic quality to subsequent offspring born to parents consuming these types of foods.

Dr. Patricia P. Scott, J.P. Greaves and M.G. Scott
Royal Free Hospital School of Medicine, London and Royal Veterinary College, London
Journal of Reproductive Fertility, 1:130-138, 1960

COFFEE & CAFFEINE DURING PREGNANCY

Evidence of Infertility and Abnormal Pregnancy Outcomes

INTRODUCTION

A very large review of the coffee/caffeine research was presented by French researcher, Dr. Astrid Nehlig, in the 1994 journal Neurotoxicology and Teratology. This review summarized over 200 medical journal articles on the links between coffee/caffeine and reproductive problems. The following are specific quotes from Dr. Nehlig's article:

"The teratogenic effect of caffeine has been clearly demonstrated in rodents. However, rodents are much more sensitive than primates to the teratogenic effects of many substances. Moreover, the quantity of caffeine needed to induce malformations in rodents reaches doses that are toxic in man. Thus a woman weighing 60 kg would have to consume 50-70 cups of coffee per day (or at least 20 cups if interspecific metabolic variations are taken into account) to absorb the equivalent of 80-100 mg/kg/day of caffeine, which is the dose usually required for development of malformations rats.

World coffee consumption is increasing. Analyzing the data from surveys carried out in the United States, Japan, and West Germany for the period of 1980-1991, it appears that the number of coffee drinkers has decreased by 2-5% in three countries, while coffee consumption, in terms of number of cups/consumer/day has increased in each country

A mean size cup (150 ml) of caffeinated coffee contains in general about 90 mg of caffeine fee and 63 mg of caffeine for soluble instant coffee. The same volume of decaffeinated coffee contains 3 mg of caffeine, whereas the content of caffeine reaches 32-42 mg in 150 ml of tea and 16 mg in 150 ml of cola drinks.

The daily consumption of caffeine in the general population ranges from 202-283 mg of caffeine which represents 2.7-4.0 mg/kg/day in males and females 20-75 years old.

The half-life of caffeine ranges from .7 -1.2 hours in the rat and mouse, 3-5 hours in the monkey and 2.5-6 hours in humans.

Caffeine half-life is increased in the neonatal period in both animals and humans due to the immaturity of hepatic (liver) enzyme systems, namely cytochrome P-450. Half lives of 40-130 hours are found in premature and newborn infants. They decrease rapidly to 14.4 and 2.6 hours in 3-5 month and 5-6 month infants, respectively. Longer half-lives of caffeine are found in breast-fed than in formula fed infants.

The U.S. Food and Drug Administration published a warning in 1980 advising pregnant women to restrict or even eliminate consumption of coffee given the "teratogenic effect" (the ability to cause birth defects) observed in rodents.

Finally, in comparing results of drug administration in both humans and animals, a correction factor for the dose must be applied, also called metabolic body weight. Indeed, dose equivalents based on metabolic body weight are substantially lower than those based on body weight: 20 mg/kg in the rat is equivalent to about 17 cups of coffee (at 100

mg/cup) in a 70-kg man on a body weight basis, but only 4 - 6 cups when corrections are made for differences in metabolic body weight.

In the monkey, spontaneous abortions and stillbirths have been recorded at the 2 doses used, 10-15 and 25-35 mg/kg/day of caffeine. (Equivalent to 2-3 cups and 5-8 cups of coffee, respectively). In humans, coffee and caffeine consumption from other sources have been associated with a higher incidence of spontaneous abortions (in 5 studies).

The risk for any kind of congenital abnormalities is 3.7% in individuals who consume caffeine and 1.7% in those who do not. The difference is statistically significant.

It has also been shown that absorption of caffeine has a vasoconstrictive effect on placental circulation. Blood flow is not modified in the umbilical fetal vein but intervillious placental blood flow is significantly diminished after absorption of 2 cups of coffee. This decrease in blood flow along with increased concentration of noradrenaline induced by caffeine in the maternal serum could represent a potential risk for the fetus.

Caffeine diffuses through the placenta and accumulates in the brain of the fetus (3 studies) Caffeine concentration of the fetal rat is higher in the brain than in the placenta whereas the metabolites of methylxanthine are evenly distributed between brain and placenta.

Exposure of female rats to caffeine during pregnancy (.04% in drinking water) causes proportionally greater loss in brain weight than in body weight (3 studies)

When pregnant rats ingest 10-20 mg/kg day caffeine, the cerebral concentrations of these various elements are lower in offspring at birth.

Exposure to caffeine during gestation and lactation (.04% in drinking water) also induces modifications in cerebral concentrations of catecholamines, tyrosine, tryptophan, serotonin, 5-hydroxyindole acetic aid, and cyclic nucleotides in the brain of 1 - 35 day old rat (4 studies), which can cause behavioral abnormalities, such as hypoactivity, during development of the animal.

Thus, it seems that early caffeine exposure, even at quite low doses, is able to induce a wide variety of neurochemical changes. These deficits concern both constitutive material such as proteins, DNA and RNA, and functional material such as neurotransmitters and ions.

Offspring of female rats exposed to 60 or 100 mg/kg caffeine in their drinking water throughout gestation have reduced learning capacities as adults in a novel environment. In an open field, these animals also spend less time grooming, playing, and touching new objects. The authors concluded that the behavioral effects induced by prenatal caffeine exposure could be related to the "hyperactive" children syndrome ."

(Sinton, C. M. et. al., 1981)

Caffeine Linked to Smaller Head Circumference - Lower Birth Weight

Although 300 mg of caffeine intake represents approximately 2 or 3 cups of coffee, many people don't realize the amount of caffeine they can consume from other sources besides coffee. Most studies, such as the ones previously mentioned, look for toxic effects based on the number of cups of coffee consumed per day. However, if significant amounts of caffeine can be ingested from other sources besides coffee, this could hide the true dangers when comparing coffee drinkers with non-coffee drinkers.

In this 1983 Ottawa study at Carleton University, Canada, the researchers analyzed the total caffeine intake from all sources in 286 pregnant women. For the first trimester of their pregnancy, coffee accounted for only 56% of their total caffeine intake, tea accounted for 37% of caffeine intake, while caffeinated soft drinks, chocolate bars, chocolate drinks and caffeinated medications accounted for approximately 7% of caffeine intake. These levels maintained about the same throughout pregnancy.

Approximately 4% of the women during pregnancy consumed 100 - 300 mg of coffee daily while 4% of the group consumed over 300 mg of coffee daily.

The researchers stated,

> *"The most marked effect associated with heavy caffeine use (over 300 mg daily) in the present study were the reduced birth weight and the smaller head circumference that persisted after statistically controlling for other potentially contributing factors."*

The mean head circumference of the infants born to the heavier caffeine users was 1.1 centimeters (cm) smaller when compared to those consuming under 300 mg of caffeine daily (33.5 cm compared with 34.6 cm, respectively). This difference was considered significant. The average weight of infants born to the heavier caffeine users was less than women consuming little caffeine (3158 grams for the higher caffeine users and 3537 for the lower caffeine user- nearly a 400 gram difference).

In summary, the researchers stated,

> *"It is during the last trimester of pregnancy that the greatest spurt in fetal growth occurs. The present results suggest that daily caffeine intake of 300 mg or more can interfere with normal fetal growth... The observed, relatively small birth weight reductions may be of minor importance to a healthy full-term baby of acceptable weight but may be of major clinical significance for a preterm or small infant."*

Drs. B. Watkinson and P. A. Fried
Carleton University, Ottawa, Ontario, Canada
Maternal Caffeine Use Before, During and After Pregnancy and Effects Upon Offspring
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