

Dietary Soy Consumption and its Impact on Male Fertility, a Systematic Review

Bailey Babin, Department of Health Sciences, Carroll College, Helena, Montana

Introduction

- Soybean production in the US in 2021 resulted in 4.5 billion bushels.¹²
- Normal sperm counts are considered to be 40 million per ml or higher. Male subfertility is a leading factor in approximately 50% of all couples experiencing infertility.³
- High consumption of soy products and by-products are becoming more prevalent in Western diets.
- While deleterious effects of phytoestrogens on reproduction have been revealed in other mammalian species, it is less clear whether it is the same for humans.⁵
- The purpose of this study is to review relevant literature to determine the effects of soy consumption on male fertility. The findings of this study should help raise awareness on the potential effects soy has on male fertility.

Methods

- Primary sources were retrieved from PubMed and CINAHL in January and February of 2023.
- Keywords included soy products, fertility, isoflavones, phytoestrogens, and estrogens.
- The articles analyzed include 3 studies involving mice, and 5 studies involving male humans.

References

1. Atanassova N, McKinnell C, Turner KJ, et al. Comparative Effects of Neonatal Exposure of Male Rats to Potent and Weak (Environmental) Estrogens on Spermatogenesis at Puberty and the Relationship to Adult Testis Size and Fertility: Evidence for Stimulatory Effects of Low Estrogen Levels*. *Endocrinology*. 2000;141(10):3898-3907. doi:10.1210/endo.141.10.7723
2. Beaton LK, McVeigh BL, Dillingham BL, Lampe JW, Duncan AM. Soy protein isolates of varying isoflavone content do not adversely affect semen quality in healthy young men. *Fertility and Sterility*. 2010;94(5):1717-1722. doi:10.1016/j.fertnstert.2009.08.055
3. Cederroth CR, Zimmermann C, Beny JL, et al. Potential detrimental effects of a phytoestrogen-rich diet on male fertility in mice. *Molecular and Cellular Endocrinology*. 2010;321(2):152-160. doi:10.1016/j.mce.2010.02.011
4. Cederroth CR, Zimmermann C, Nef S. Soy, phytoestrogens and their impact on reproductive health. *Molecular and Cellular Endocrinology*. 2012;355(2):192-200. doi:10.1016/j.mce.2011.05.049
5. Chavarro JE, Toth TL, Sadio SM, Hauser R. Soy food and isoflavone intake in relation to semen quality parameters among men from an infertility clinic. *Human Reproduction*. 2008;23(11):2584-2590. doi:10.1093/humrep/den243
6. Levine H, Jørgensen N, Martino-Andrade A, et al. Temporal trends in sperm count: a systematic review and meta-regression analysis of samples collected globally in the 20th and 21st centuries. *Human Reproduction Update*. 2023;29(2):157-176. doi:10.1093/humupd/dmac035
7. Mínguez-Alarcón L, Afeiche MC, Chiu Y-H, et al. Male soy food intake was not associated with in vitro fertilization outcomes among couples attending a fertility center. *Andrology*. 2015;3(4):702-708. doi:10.1111/andr.12046
8. Povey AC, Clyma J, McNamee R, et al. Phytoestrogen intake and other dietary risk factors for low motile sperm count and poor sperm morphology. *Andrology*. 2020;8(6):1805-1814. doi:10.1111/andr.12858
9. Schardt D. SOY OH SOY! Is it really bad for you? *NUTR ACTION HEALTHLETT*. 2014;41(7):9-11.
10. van Erp-Baart MAJ, Brants HAM, Kieley M, et al. Isoflavone intake in four different European countries: the VENUS approach. *Br J Nutr*. 2003;89(S1):S25-S30. doi:10.1079/BJN2002793
11. West MCL, Anderson L, McClure N, Lewis SEM. Dietary oestrogens and male fertility potential. *Human Fertility*. 2005;8(3):197-207. doi:10.1080/1464727050030266
12. Corn and soybean production up in 2021, USDA Reports Corn and soybean stocks up from year earlier, Winter Wheat Seedlings up for 2022. Accessed April 12, 2023. <https://www.nass.usda.gov/Newsroom/2022/01-12-2022.php>
13. Telpner M. Soy Foods: Hidden Sources, Health and Environmental Impact. Meghan Telpner. Published September 13, 2019. Accessed April 12, 2023. <https://www.meghantelpner.com/blog/soy-foods-hidden-sources-health-and-environmental-impact/>
13. Fertility crisis leaves little time for solution - EHN. Accessed April 12, 2023. <https://www.ehn.org/fertility-crisis-2650749642.html>



Figure 1. Hidden Sources of Soy¹²

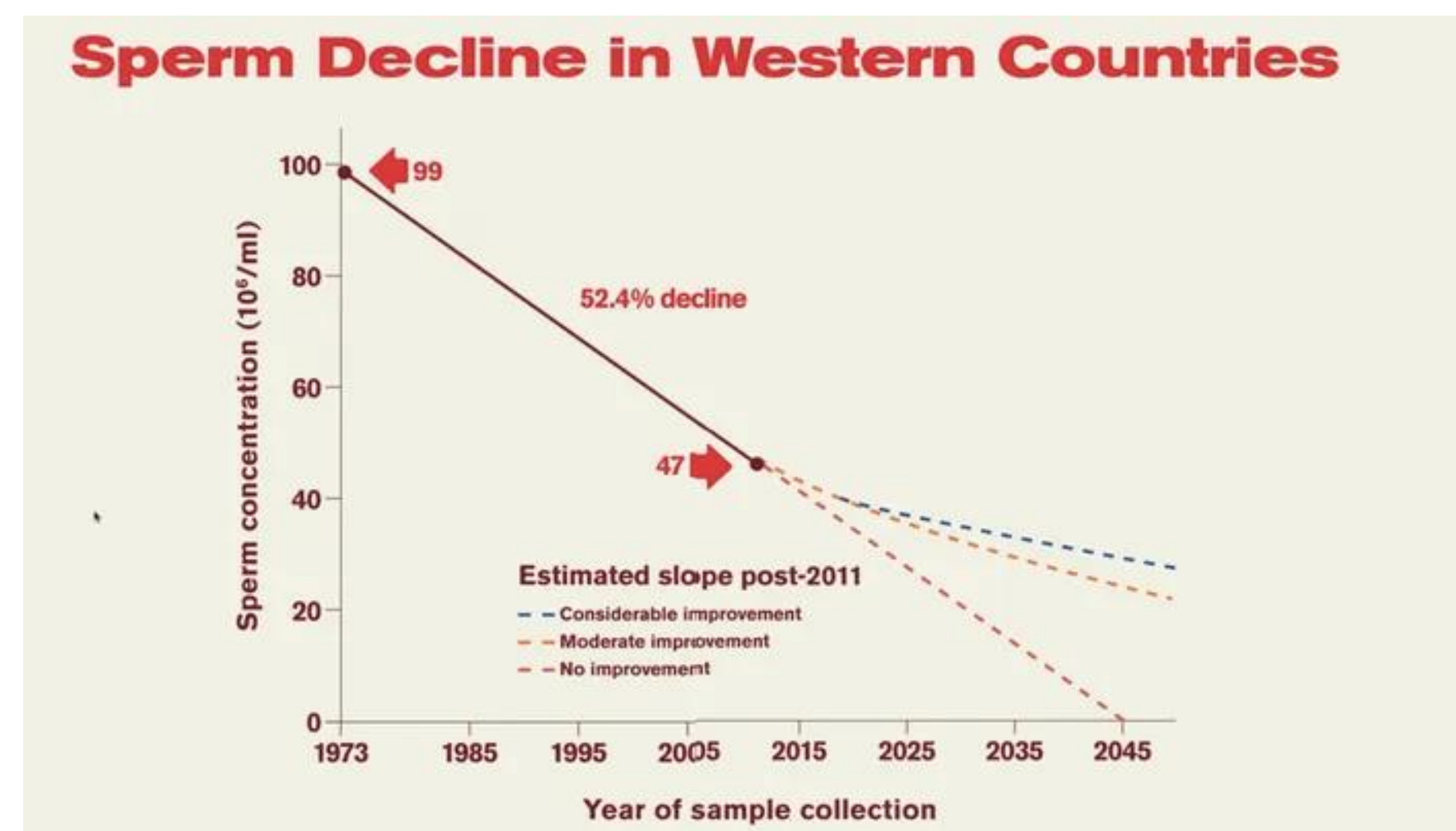


Figure 2. Sperm Decline in Western Countries¹³

Results

- This review included one randomized crossover intervention,² three randomized controlled trials,^{4,5,11} two case-controlled studies,^{7,10} an ongoing prospective cohort⁸ and a cross sectional analysis.³
- Overall, the presence of dietary isoflavones and estrogens yielded adverse effects on male fertility with two studies suggesting further research before coming to a concrete conclusion.^{7,11}

Discussion

- Some of the studies analyzed in this review provide evidence that the presence of dietary isoflavones and estrogens yielded adverse effects on male fertility,^{3,4,5,11} such as decreased sperm counts and motility, while the rest did not find adverse effects on fertility.^{2,7,8}
- Soy isoflavones act as a weak estrogen which can act as an agonist or antagonist, causing a decrease in fertility.
- A potential concern of soy is its increasing prevalence in the Western diet, as well as other chemicals including phthalates.
- The findings of this study can help guide fertility clinic practice pertaining to dietary recommendations, as well as national dietary guidelines.

Acknowledgements

I would like to thank Dr. Gerald Schafer and the Department of Health Sciences for the continuous guidance and support.