Fermented Soyfoods and Health: Are They Really Better for You Than Tofu and Soymilk?

Author : Dr. Mark Messina

Date : August 9, 2016

Hundreds of studies published over the past 25 years have quantified soy intake among Asian populations using food frequency questionnaires and, to a lesser extent, dietary records. The research clearly shows that non-fermented foods like tofu and soymilk play as big a role as fermented soy products. In some parts of Asia, these non-fermented soyfoods provide the bulk of soy intake.

Since soyfood consumption is associated with certain health benefits, it makes sense that non-fermented soyfoods are perfectly healthful choices. But blog posts and articles in popular magazines continue to reinforce the mistaken idea that only fermented soyfoods like tempeh, miso and natto, should be consumed.

It's an idea that is based almost exclusively on theoretical considerations. I'll address those in just a bit. But first it's important to point out that very few clinical studies have intervened with traditional Asian soyfoods such as tofu, which is unfermented, or with fermented soyfoods such as tempeh or miso. Most have used either isoflavone supplements or isolated soy protein. And no clinical trials were identified that have compared the effects of fermented versus unfermented soy on health outcomes.

There have, however, been several epidemiologic studies from Japan that evaluated relationships between both tofu and miso and health outcomes. Most have shown that tofu is more likely than miso to be associated with reduced risk for chronic disease.[1-3] One exception is for bone health. Most likely because of its high vitamin K content, the fermented food natto is associated with bone health, whereas tofu consumption may not have an impact.[4]

Whether or not tofu is better for health than miso isn't really clear, but at the very least, the epidemiologic studies don't support any advantage for consuming fermented soyfoods. That leaves us with theoretical ideas about advantages of fermented soyfoods which deal, for the most part, with nutrition rather than chronic disease.

Fermented Soy and Protein Digestion

Soybeans contain protease inhibitors (PI) such as the Bowman Birk Inhibitor (BBI) and the trypsin inhibitor (TI). These enzyme inhibitors interfere with activity of proteases that are involved in the digestion of protein. The practical implications on protein nutrition are minimal, however, since

much of the PI content in soybeans is inactivated during processing. In particular, the application of moist heat, used in the production of most soyfoods, deactivates these compounds.

Commercial soy products have been thought for quite some time to contain between 5% and 20% residual PI content,[5-8] a point which is illustrated by the values for a variety of commercial soy products.[9,10] While some brands of soymilk have recently been found to contain more active PI than traditionally thought, it's doubtful that this matters.[11] In animal studies, at least, protein digestion is appreciably affected only when more than 50% of the PI content remains, which is not the case for soymilk.[12]

Fermentation can also inactivate PI, but the extent to which this occurs depends upon several factors. One of these is the extent of fermentation, which means that the amount of PI in fermented versus unfermented soyfoods isn't easily predictable. Furthermore, digestion of soy protein products such as isolated soy protein, is excellent at over 90%.[13] Available data show that protein in tofu is also very well digested.[14] Therefore, it doesn't appear that fermentation would substantially improve protein digestion.

Fermentation and Mineral Absorption

Like other legumes as well as whole grains and seeds, soybeans and soyfoods contain phytate, a storage form of phosphorus for plants. Phytate can bind to minerals such as zinc, iron and calcium, and inhibit their absorption. Because fermentation degrades phytates, this process should theoretically improve mineral absorption. The extent to which this matters, though, is variable. In fact, despite their high phytate content, absorption of calcium from calcium-fortified soymilk[15] and calcium-set tofu[16] is similar to the absorption of calcium from cow's milk.

Iron absorption from high-phytate soyfoods also may be quite high, probably because much of the iron is in the form of ferritin.[17] Finally, new research shows there is adaptation to the inhibitory effects of phytate on mineral absorption.[18] That is, over time in response to the consumption of a high-phytate diet, phytate has much less effect on mineral absorption. This adaptation has thus far only been shown to be true for iron but there is every reason to think it applies to calcium and zinc as well.

Fermentation and Isoflavone Absorption

Claims have been made that fermentation boosts isoflavone absorption and also that it decreases isoflavone content. There is no clear evidence that either is true, although fermentation may cause isoflavones to be absorbed quickly.[19-21] This is because it causes isoflavones in glycoside form to be converted to the aglycone form.

Both Fermented and Non-Fermented Soyfoods Contribute to Good Health

There may be other effects of fermentation on soyfoods that impact their relationship to health. For example, fermentation can lead to production of new antioxidants. However, the current science does not support recommendations to choose fermented soyfoods over traditional products like soymilk and tofu. All soyfoods can play a role in healthful diets.

References

1. Shin A, Lee J, Park MS, et al. Isoflavone and soyfood intake and colorectal cancer risk: A case-control study in Korea. PLoS One. 2015;10:e0143228.
2. Yan L, Spitznagel EL. Soy consumption and prostate cancer risk in men: a revisit of a meta-analysis. The American journal of clinical nutrition. 2009;89:1155-63.
3. Yang WS, Va P, Wong MY, Zhang HL, Xiang YB. Soy intake is associated with lower lung cancer risk: results from a meta-analysis of epidemiologic studies. The American journal of clinical nutrition. 2011;94:1575-83.
4. Ikeda Y, Iki M, Morita A, et al. Intake of fermented soybeans, natto, is associated with reduced bone loss in postmenopausal women: Japanese Population-Based Osteoporosis (JPOS) Study. The Journal of nutrition. 2006;136:1323-8.
5. Friedman M, Brandon DL. Nutritional and health benefits of soy proteins. Journal of agricultural and food chemistry. 2001;49:1069-86.
6. Liener IE. Implications of antinutritional components in soybean foods. Critical reviews in food science and nutrition. 1994;34:31-67.
7. Rackis JJ, Gumbmann MR. Protease inhibitors: physiological properties and nutritional significance. In: Ory RL, ed. Antinutrients and Natural Toxicants in Foods. Westport, CT: Food and Nutrition Press.; 1981:203-38.
8. Dipeitro CM, Liener IE. Soybean protease inhibitors in foods. J Food Sci. 1989;54:606-17.
9. Gilani GS, Cockell KA, Sepehr E. Effects of antinutritional factors on protein digestibility and amino acid availability in foods. Journal of AOAC International. 2005;88:967-87.
10. Miyagi Y, Shinjo S, Nishida R, et al. Trypsin inhibitor activity in commercial soybean products in Japan. J Nutr Sci Vitaminol (Tokyo). 1997;43:575-80.
11. Xiao CW, Wood CM, Robertson P, Gilani GS. Protease inhibitor activities and isoflavone content in commercial soymilks and soy-based infant formulas sold in Ottawa, Canada. Journal of Food Comp Anal. 2011;25:130-6.
12. Rackis JJ, McGhee JE, Booth AN. Biological threshold levels of soybean trypsin inhibitors by rat bioassay. Cereal Chem. 1975;52:85-92.
13. Hughes GJ, Ryan DJ, Mukherjea R, Schasteen CS. Protein digestibility-corrected amino acid scores (PDCAAS) for soy protein isolates and concentrate: Criteria for evaluation. Journal of agricultural and food chemistry. 2011;59:12707-12.
14. Chen ML, Lin T, Chen JS. Digestion and utilization of vegetable proteins in human subjects. Chin J Physiol. 1972;21:79-88.
15. Zhao Y, Martin BR, Weaver CM. Calcium bioavailability of calcium carbonate fortified soymilk is equivalent to cow's milk in young women. The Journal of nutrition. 2005;135:2379-82.

16. Weaver CM, Heaney RP, Connor L, Martin BR, Smith DL, Nielsen E. Bioavailability of calcium from tofu vs. milk in premenopausal women. J Food Sci. 2002;68:3144-7.
17. Lonnerdal B. Soybean ferritin: implications for iron status of vegetarians. The American journal of clinical nutrition. 2009;89:1680S-5S.
18. Armah SM, Boy E, Chen D, Candal P, Reddy MB. Regular consumption of a high-phytate diet reduces the inhibitory effect of phytate on nonheme-iron absorption in women with suboptimal iron stores. The Journal of nutrition. 2015;145:1735-9.
19. Yuan B, Zhen H, Jin Y, et al. Absorption and plasma disposition of genistin differ from those of genistein in healthy women. Journal of agricultural and food chemistry. 2012;60:1428-36.
20. Zubik L, Meydani M. Bioavailability of soybean isoflavones from aglycone and glucoside forms in American women. The American journal of clinical nutrition. 2003;77:1459-65.
21. Setchell KD, Brown NM, Desai P, et al. Bioavailability of pure isoflavones in healthy humans and analysis of commercial soy isoflavone supplements. The Journal of nutrition. 2001;131:1362S-75S.