FSHN12-17

Functional Foods[1]

Amanda L. Ford and Wendy J. Dahl[2]

What are functional foods?

Currently, there is no universally accepted definition of a functional food in the United States. Instead, a functional food is commonly defined as a food that provides benefits beyond the basic nutrition provided by that food. The additional benefit is due to a component in the food item that offers physical or biological—i.e., functional—benefit.

Functional foods have become increasingly popular in the United States and worldwide (Statista n.d.). Some foods naturally contain a functional component, whereas, with other foods, a functional ingredient is added to create a functional food. Functional foods may help reduce the risk of certain diseases or improve overall health.

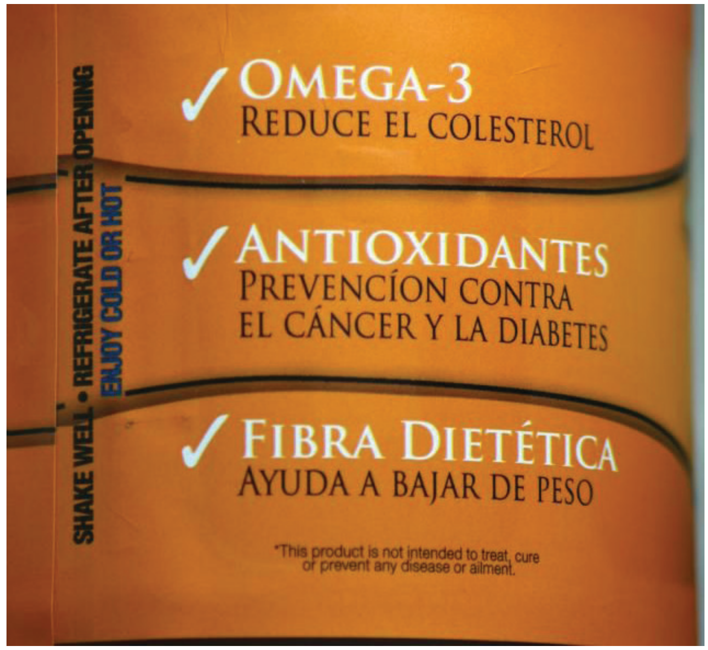

Figure 1. Food label of unknown origin featuring various structure-function claims, together with fine-print disclaimer that reads, "This product is not intended to treat, cure or prevent any disease or ailment."
Credits: Kai Schreiber, CC BY-SA 2.0, https://flic.kr/p/88c3bq

How are functional foods regulated?

The US Food and Drug Administration (FDA) is the government agency responsible for regulating and ensuring the safety of food. Because the FDA does not have a formal definition of a functional food, the rules regulating functional foods depend on how the manufacturer chooses to market the food product to the consumer.

A manufacturer can market its product as a whole food, or as enriched food, fortified food, or enhanced food if nutrients are added:

- **Enriched**—the addition of one or more nutrients that were lost during food processing
- **Fortified**—the addition of one or more nutrients into a food
- **Enhanced—**the addition of one or more nutrients into a food by modification or indirect methods

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2. Amanda L. Ford, graduate student; and Wendy J. Dahl, associate professor; Department of Food Science and Human Nutrition, UF/IFAS Extension, Gainesville, FL 32611.

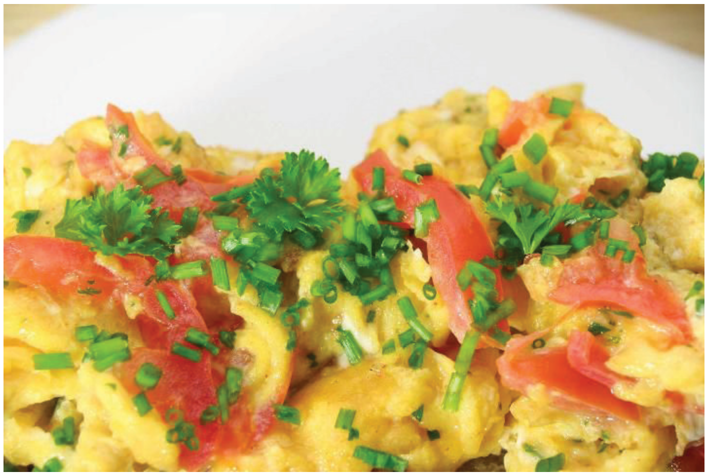

Figure 2. Scrambled omega-3 eggs with tomato.
Credits: Dirk Richter/istockphoto.com

Claims Made for Functional Foods

The FDA is also responsible for monitoring the health claims that manufacturers make for their food products (DHHS). As a consumer, it is important to take notice of the claims that may be located on the packaging of functional foods. Most claims on functional food labels are considered structure-function claims. Structure-function claims are often placed on foods and are not highly regulated by the FDA. The Federal Food, Drug and Cosmetic Act (DHHS) states that a structure-function claim cannot be proven to be false or misleading to the consumer and cannot claim to treat, cure, or prevent a disease or disease condition. Some examples of structure-function claims are "Calcium builds strong bones," "Vitamin D helps contribute to bone health," and "Vitamin A may help to contribute to maintenance of healthy vision."

Classification of Functional Foods

Functional foods can be divided into two broad categories. The first category consists of functional foods that naturally contain a component that offers additional benefits to the consumer. The other category of functional foods consists of processed foods in which a component is added to the food to give it additional benefits.

Foods with Naturally Occurring Functional Components

Tomato is an example of a functional food because it contains the bioactive component lycopene. Lycopene is associated with a decreased risk of prostate cancer (Chen et al. 2015). Table 1 lists some examples of functional foods along with the component that occurs naturally in the food item and its possible health benefits. Many of the foods in this category are commonly found in your grocer's produce department.

Foods with Enhanced Functional Components

Omega-3 enriched eggs are considered a functional food because they contain the bioactive food ingredient omega-3 fatty acids. Omega-3 fatty acids are not added directly to the eggs. Instead the hens that lay these eggs are given a feed that contains large amounts of an ingredient (commonly flax seed) that is high in omega-3 fats. Omega-3 fatty acids are thought to reduce the risk of fatal coronary heart disease (Del Gobbo et al. 2016).

Foods with Added Functional Ingredients

Table 2 lists functional foods along with the components that manufacturers have added and their possible benefits. The foods in this category are generally processed. Examples include orange juice with added vitamin D, breads and cereals with added fiber, and a wide variety of other food products.

Should we consume functional foods?

Functional foods may provide additional health benefits to you if you consume them regularly as part of a varied diet. As functional foods become increasingly popular in the United States, it is important to be an informed shopper.

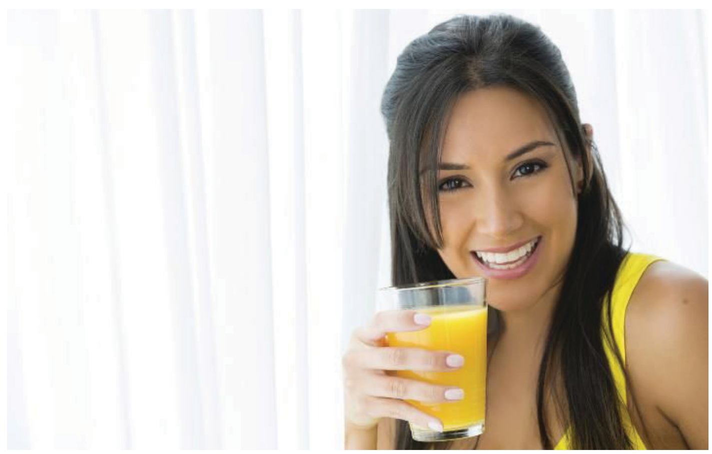

Figure 3. Orange juice.
Credits: LattaPictures/istockphoto.com

References

Aune, D., N. Keum, E. Giovannucci, L. T. Fadnes, P. Boffetta, D. C. Greenwood, S. Tonstad, L. J. Vatten, E. Riboli, and T. Norat. 2016. "Whole Grain Consumption and Risk of Cardiovascular Disease, Cancer, and All Cause and Cause Specific Mortality: Systematic Review and Dose-Response Meta-Analysis of Prospective Studies." *British Medical Journal* 353: 2716. https://doi.org/10.1136/bmj.i2716

Chen, O., M. Eunice, and l. DeAnn. 2019. "Effect of Cranberry on Urinary Tract Infection Risk: A Meta-Analyses (P06-116-19)." *Current Developments in Nutrition.* 3:116–19. https://doi.org/10.1093/cdn/nzz031.P06-116-19

Chen, P., W. Zhang, X. Wang, K. Zhao, D. S. Negi, L. Zhuo, M. Qi, X. Wang, and X. Zhang. 2015. "Lycopene and Risk of Prostate Cancer: A Systematic Review and Meta–Analysis." *Medicine (Baltimore)* 94 (33): e1260. https://doi.org/10.1097/md.0000000000001260

Cheng, Ho Ming, G. Koutsidis, J. K. Lodge, A. Ashor, M. Siervo, and J. Lara. 2017. "Tomato and Lycopene Supplementation and Cardiovascular Risk Factors: A Systematic Review and Meta-Analysis." Atherosclerosis 257:100-108. https://doi.org/10.1016/j.atherosclerosis.2017.01.009

Chowdhury, R., S. Stevens, D. Gorman, A. Pan, S. Warnakula, S. Chowdhury, H. Ward, et al. 2012. "Association between Fish Consumption, Long Chain Omega 3 Fatty Acids, and Risk of Cerebrovascular Disease: Systematic Review and Meta-Analysis." *British Medical Journal* 345: e6698. https://doi.org/10.1136/bmj.e6698

Cui, Chendi, Rahel L. Birru, Beth E. Snitz, Masafumi Ihara, Chikage Kakuta, Brian J. Lopresti, Howard J. Aizenstein, Oscar L. Lopez, Chester A. Mathis, Yoshihiro Miyamoto, Lewis H. Kuller, and Akira Sekikawa. 2020. "Effects of Soy Isoflavones on Cognitive Function: A Systematic Review and Meta-Analysis of Randomized Controlled Trials." *Nutrition reviews* 78 (2): 134-144. https://doi.org/10.1093/nutrit/nuz050

Del Gobbo, L. C., F. Imamura, S. Aslibekyan, M. Marklund, J. K. Virtanen, M. Wennberg, M. Y. Yakoob, et al. 2016. "Omega-3 Polyunsaturated Fatty Acid Biomarkers and Coronary Heart Disease: Pooling Project of 19 Cohort Studies." *JAMA Internal Medicine*. https://doi.org/10.1001/jamainternmed.2016.2925

Hohmann, C. D., H. Cramer, A. Michalsen, C. Kessler, N. Steckhan, K. Choi, and G. Dobos. 2015. "Effects of High Phenolic Olive Oil on Cardiovascular Risk Factors: A Systematic Review and Meta-Analysis." *Phytomedicine* 22 (6): 631–40. https://doi.org/10.1016/j.phymed.2015.03.019

Jayedi, A., M. Sadat Zargar, and S. Shab-Bidar. 2019. "Fish Consumption and Risk of Myocardial Infarction: A Systematic Review and Dose-Response Meta-Analysis Suggests a Regional Difference." *Nutrition Research* 62:1–12. https://doi.org/10.1016/j.nutres.2018.10.009

Kotwal, S., M. Jun, D. Sullivan, V. Perkovic, and B. Neal. 2012. "Omega 3 Fatty Acids and Cardiovascular Outcomes: Systematic Review and Meta-Analysis." *Circulation: Cardiovascular Quality and Outcomes* 5 (6): 808–18. https://doi.org/10.1161/circoutcomes.112.966168

Liang, S., G. Lv, W. Chen, J. Jiang, and J. Wang. 2014. "Citrus Fruit Intake and Bladder Cancer Risk: A Meta-Analysis of Observational Studies." *International Journal of Food Sciences and Nutrition* 65 (7): 893–8. https://doi.org/10.3109/09637486.2014.917151

Micali, S., G. Isgro, G. Bianchi, N. Miceli, G. Calapai, and M. Navarra. 2014. "Cranberry and Recurrent Cystitis: More Than Marketing?" *Critical Reviews in Food Science and Nutrition* 54 (8): 1063–75. https://doi.org/10.1080/10408398.2011.625574

Song, J. K., and J. M. Bae. 2013. "Citrus Fruit Intake and Breast Cancer Risk: A Quantitative Systematic Review." *J Breast Cancer* 16 (1): 72–6. https://doi.org/10.4048/jbc.2013.16.1.72

Statista. n.d. "Statistics and Facts on the Functional Foods Market in the U.S." Accessed March 20, 2020. https://www.statista.com/topics/1321/functional-foods-market/

Tokede, O. A., T. A. Onabanjo, A. Yansane, J. M. Gaziano, and L. Djousse. 2015. "Soya Products and Serum Lipids: A Meta-Analysis of Randomised Controlled Trials." *British Journal of Nutrition* 114 (6): 831–43. https://doi.org/10.1017/s0007114515002603

U.S. Department of Health and Human Services. U.S. Food and Drug Administration. 2000. "Structure/Function Claims." Accessed August 5, 2022. https://www.fda.gov/food/food-labeling-nutrition/structurefunction-claims

Wang, A., C. Zhu, L. Fu, X. Wan, X. Yang, H. Zhang, R. Miao, L. He, X. Sang, and H. Zhao. 2015. "Citrus Fruit Intake Substantially Reduces the Risk of Esophageal Cancer: A Meta-Analysis of Epidemiologic Studies." *Medicine (Baltimore)* 94 (39): e1390. https://doi.org/10.1097/md.0000000000001390

Table 1. Foods with functional components.

Functional Food	Functional Component*	Potential Benefit
Tomatoes, Watermelon	Lycopene	Lower risk of prostate cancer (Chen et al. 2015) Reduced LDL cholesterol and systolic blood pressure, and improved the endothelial function in the heart (Cheng et al. 2017)
Citrus	Flavanones	Reduced risk of some cancers (Wang et al. 2015, Liang et al. 2014, Song and Bae 2013)
Soy-based foods	Isoflavones	Lower LDL, total cholesterol and triglycerides, and improved HDL (Tokede et al. 2015). Improved cognitive function in adults (Cui et al. 2020).
Cranberries	Proanthocyanidins	Lower risk of urinary tract infection (Chen, Mah, and Liska 2019, Micali et al. 2014)
Fatty fish	Omega-3 fatty acids	Reduced risk of cardiovascular disease (Chowdhury et al. 2012, Jayedi, Zargar, and Shab-Bidar 2019)
Whole grain foods	Bran/fiber	Reduced risk of cardiovascular disease, cancer, and mortality from all causes (Aune et al. 2016)
***Note: Other components of these whole foods may contribute to the potential benefit beyond the functional component listed.**		

Table 2. Foods with added functional ingredients.

Functional Food	Functional Ingredient	Potential Benefit
Orange juice with added vitamin D	Vitamin D	Reduced risk of bone diseases
Yogurt with a probiotic	Probiotic	Gastrointestinal wellness
Breads and cereals with added fiber	Fiber	Alleviates constipation
Margarine fortified with plant sterols	Plant sterols	Reduces cholesterol