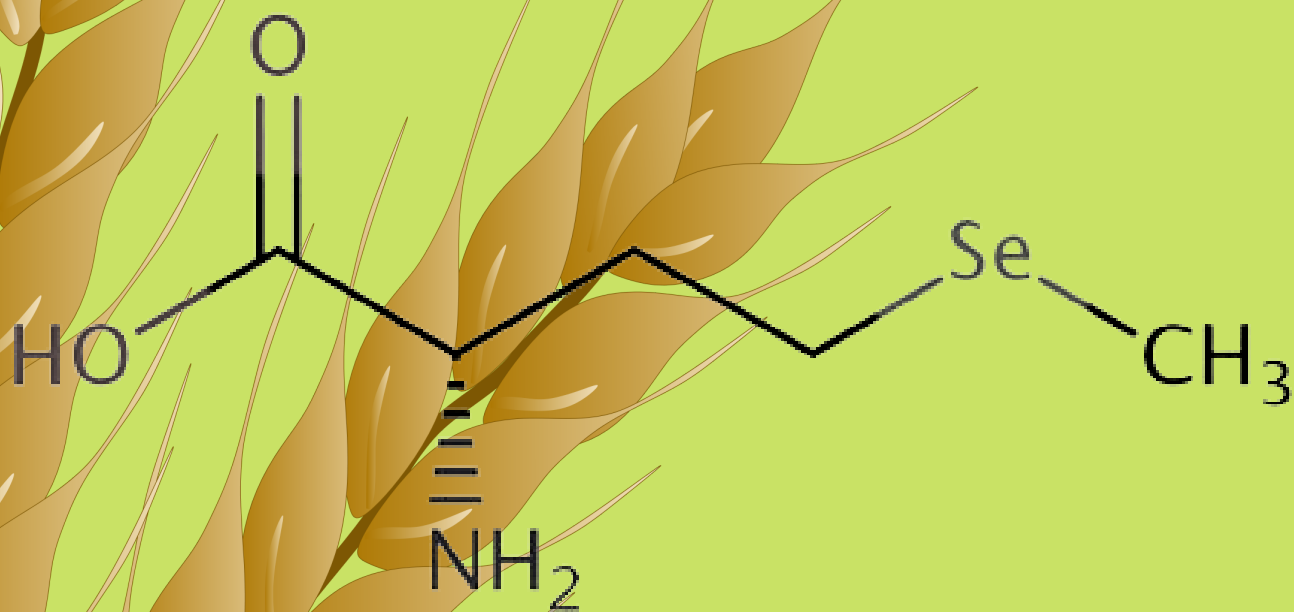


For Selenium's Sake



Yuri Kruse

www.fishybusiness.site

For Selenium's Sake

Copyright © 2022 by Youri Kruse
All Rights Reserved.

No part of this book (my own writings) may be used for profit by any means, graphic, electronic, or mechanical, including photocopying, recording, taping, or by any information storage retrieval system without the written permission of the publisher except in the case of brief quotations embodied in critical articles and reviews.

I generally don't like supplement (except for specifics), however, if you know you have a low selenium intake, you might want to try selenium. Always do your own research and know, you are responsible for your own health.

Youri Kruse

For Selenium's Sake

“There is damn good evidence that selenium has anti-cancer value. If we want to avoid cancer getting cancer, we should be sure to get enough selenium”

Dr Douglas Frost. Former researcher at Dartmouth Medical School’s Trace Element Laboratory

“A majority of the scientists said they are satisfied that available data is sufficient to indicate that supplementation of the diet with 100 to 200 microgram of selenium will reduce the occurrence of some cancer in humans”

San Diego Union. 10 January, 1979

“the key to cancer prevention lies in assuring the adequate intake of selenium, as well as other trace elements”

Dr. Gerhard Schrauzer. University of California

“There is no question that there is a certain relationship between areas poor in selenium and areas with a high frequency of cancer in general. It is clear at this point selenium is considered an important element in the whole story of cancer in general”

Dr. Pietro Gullino. Chief of the laboratory of pathophysiology and chairman of the Breast Cancer Task Force.

“Selenium has had dramatic acceptance in animal husbandry. However, in those countries where selenium content is minimal, the farmer who feeds his cattle selenium supplement is often himself the victim of infarctions that would have been prevented by a selenium supplement.”

SELENIUM IN NUTRITION JOHAN BJORKSTEN. PhD Bjorksten Research Foundation Madison. WI. 1981

“selenium is one of the extremely protective nutrients that prevent atherosclerosis in animal experiments with excess cholesterol.”

Ray Peat PhD.

“There seems to be a causal relationship between having high-selenium levels and not having cancer”

Dr. Charles Shaw. Anderson Hospital and Tumor Institute

“If selenium has an effect on heart disease – and the evidence points to it – then Americans are probably 100 to 150 micrograms short in their selenium intakes”

Dr. Shamberger

“These findings are consistent with the hypothesis that low selenium concentrations may have a role in the pathogenesis of asthma in New Zealand”

Flatt, A et al. “Reduced selenium in asthmatic subjects in New Zealand.” *Thorax* vol. 45,2 (1990): 95-9. doi:10.1136/thx.45.2.95

There was a significant decrease in the concentration of selenium in the leucocytes as well as in whole blood and plasma in the patients.”

Hinks, L J et al. “Reduced concentrations of selenium in mild Crohn's disease.” *Journal of clinical pathology* vol. 41,2 (1988): 198-201. doi:10.1136/jcp.41.2.198

“Lung cancer appeared in the workers with the lowest selenium lung tissue levels”

Gerhardsson, L., Brune, D., Nordberg, I. G., & Wester, P. O. (1985). Protective effect of selenium on lung cancer in smelter workers. *British journal of industrial medicine*, 42(9), 617–626. <https://doi.org/10.1136/oem.42.9.617>

“The concentrations of selenium were significantly lower in the leucocytes, blood, and plasma of patients compared with controls, probably indicating a decrease in the body content of selenium”

Hinks, L. J., Inwards, K. D., Lloyd, B., & Clayton, B. E. (1984). Body content of selenium in coeliac disease. *British medical journal (Clinical research ed.)*, 288(6434), 1862–1863. <https://doi.org/10.1136/bmj.288.6434.1862>

“Significantly lower selenium values were observed in sera from cancer patients than from normal individuals.”

McConnell KP, Broghamer WL Jr, Blotcky AJ, Hurt OJ. Selenium levels in human blood and tissues in health and in disease. *J Nutr.* 1975 Aug;105(8):1026-31. doi: 10.1093/jn/105.8.1026. PMID: 1142009.

“The negative correlation indicates an inverse relationship between selenium blood levels and the human cancer death rates.”

Shamberger RJ, Frost DV. Possible protective effect of selenium against human cancer. *Can Med Assoc J.* 1969;100(14):682.

“A high mortality rate was recorded for lambs whose mothers had low selenium levels in their blood”

Lindberg, P., & Jacobsson, S. O. (1970). Relationship between selenium content of forage, blood and organs of sheep, and lamb mortality rate. *Acta veterinaria Scandinavica*, 11(1), 49–58. <https://doi.org/10.1186/BF03548003>

Selenium

“The concentration of selenium in the Earth’s crust is less than that of gold”

Selenium is a mineral that is needed for health. Selenium is a bit of a mystery as it is historically associated with toxicity. The mineral selenium was first discovered by Berzelius in 1817. The electrical properties of selenium made it useful for xerographic (different parts in the photocopy processes). The first association of selenium with nutrition is toxicity. Soils with high selenium content gave cattle “blind staggers” that would eventually lead to death.

The biological significance of selenium was not recognized until it was identified as the toxic principle causing lameness and death in livestock grazing certain range plants in the Dakotas and Wyoming (Franke, 1934).

Selenium in nutrition by National Research Council (U.S.). Subcommittee on Selenium 1983

In those same areas, however, in humans eating the high selenium foods, selenium toxicity was rare. Furthermore many areas with more selenium in the ground, people tended to live longer. Some studies found that selenium actually aiding in cancer survival and no toxic effects were found. A report from 1935 found that;

Selenium, on the other hand, has a record—experimental and clinical—in the treatment of cancer, dating back nearly twenty years, and nowhere, so far as I have been able to ascertain, is there any record of a toxic effect from selenium in medicinal doses.

18 may 1935, The British Medical Journal

The Problem With Selenium

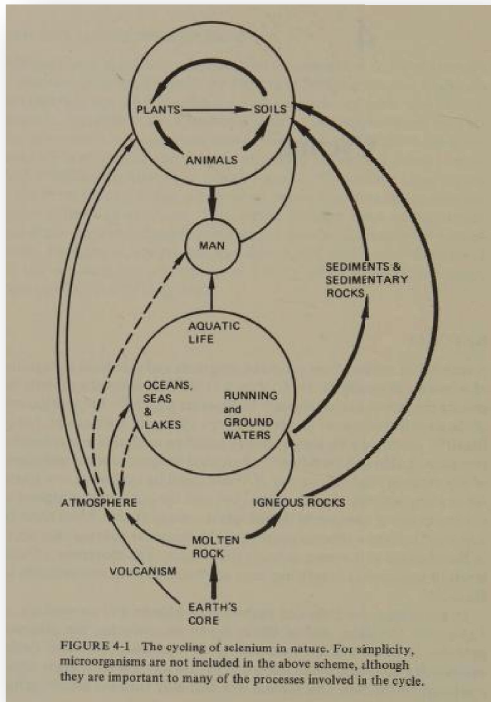
With a history of toxicity and scarcity, selenium is often ignored and forgotten. To complicate selenium even more, plants don't require selenium to grow, but we, and the animals we might eat do need it.

Selenium (Se), while not required by plants, is an essential trace element for adequate nutrition and health for fish, birds, animals, and humans. Generally, diets containing 0.1–0.3 mg/kg Se will provide adequate Se for these various animals. However, many soils are incapable of providing that amount to the plants growing on them. Animals consuming low-Se diets will be Se-deficient, grow poorly, or even die.

Selenium in the environment. 1994

Selenium is unevenly distributed, with a very low soil content in former glaciated areas (northern Europe, parts of China), Eastern Europe and New Zealand. Even within a country some areas can be overloaded while other areas might be deficient (like in the USA and China). Furthermore, modern farming makes the uptake of selenium less likely. Organic fertilizers often times don't contain selenium, making many organic foodstuffs less likely to contain adequate selenium levels. The artificial sulfur based fertilizer is one of the main reasons why selenium uptake is low (sulfur is straight above selenium on the periodic table). It is thought that selenium comes from the earth's core and is transported in great amounts by molten rocks into lakes, seas and the ground water, areas with volcanic activities are rich in selenium.

For Selenium's Sake



Selenium by National Research Council (U.S.). Subcommittee on Selenium Publication date 1976

Beyond natural factors, human activities have a huge impact by burning coal and its derivatives. Together with toxins, selenium gets distributed by manufacturing processes. However as selenium binds to toxins, this selenium is not very useful.

“Human activities are significantly impacting the global Se cycle. Andren ... concluded that 1.5 to 2.5 times as much Se is mobilized through coal burning as by natural weathering processes”

Selenium in Seleniferous Environments H. F. Mayland USDA-Agricultural Research Service Kimberly, Idaho L. F. James and K. E. Panter USDA-Agricultural Research Service Logan, Utah J. L. Sonderegger Montana Bureau of Mines and Geology Butte, Montana

Selenium & Health

“This review of recently published studies on Se intake and status throughout Europe, the UK and the Middle East shows that Se deficiency is widespread among these populations and agrees with previous reports highlighting the problem”

Stoffaneller, Rita, and Nancy L Morse. “A review of dietary selenium intake and selenium status in Europe and the Middle East.” *Nutrients* vol. 7,3 1494-537. 27 Feb. 2015, doi:10.3390/nu7031494

”Selenium deficiency is regarded as a major health problem for 0.5 to 1 billion people worldwide, while an even larger number may consume less selenium than required for optimal protection against cancer, cardiovascular diseases and severe infectious diseases including HIV disease. Efficient recycling of selenium is difficult. Selenium is added in some commercial fertilizers, but only a small proportion is taken up by plants and much of the remainder is lost for future utilization”

Haug, A., Graham, R. D., Christophersen, O. A., & Lyons, G. H. (2007). How to use the world's scarce selenium resources efficiently to increase the selenium concentration in food. *Microbial ecology in health and disease*, 19(4), 209–228. <https://doi.org/10.1080/08910600701698986>

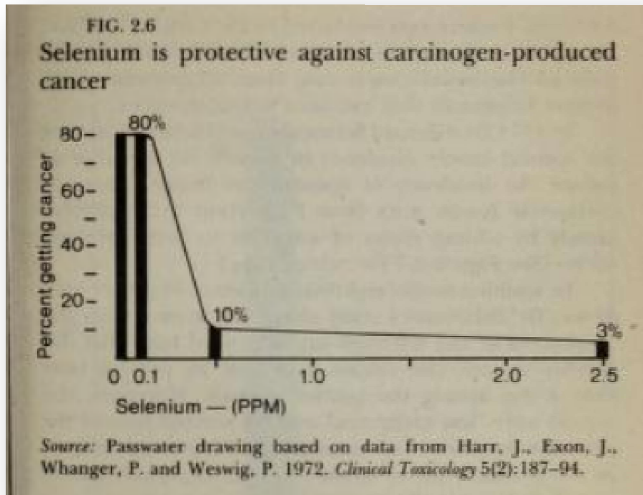
Research early on in the in 1940s and 1950 showed great potential with selenium. These experiments were conducted on animals and although impressive, received limited attention. Selenium showed to reduce the incidence of cancer by more than 30%. Even though the scientists at the time were expecting selenium toxicity, they found selenium (even in an inorganic form) inhibited tumors. Some scientist noted;

Thus the inhibiting effect of selenium on tumor developments was evident in spite of accompanying influences in the opposite direction.

CLAYTON CC, BAUMANN CA. Diet and azo dye tumors; effect of diet during a period when the dye is not fed. *Cancer Research*. 1949 Oct;9(10):575-582. PMID: 18141504

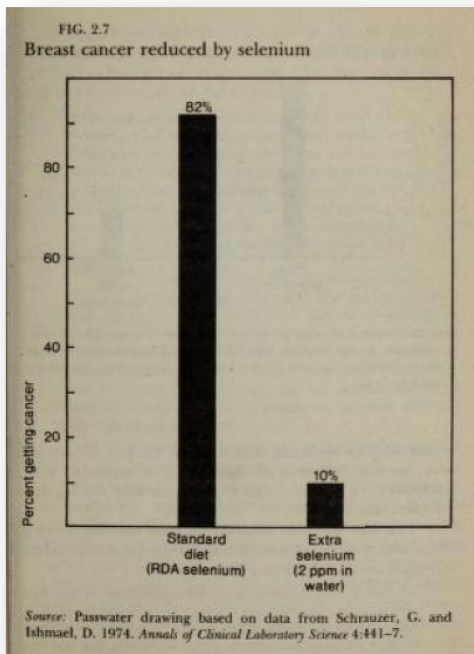
Harr and his colleagues used FAA (a carcinogen) to induce cancer in mice. The study divided the mice into 4 groups (group 1 FAA and 2.5 ppm selenium, group 2 FFA and 0.5 ppm selenium, group 3 FFA and 0.1 ppm selenium, while group 4 contained FAA and no selenium). After 210 days, 80% of the mice in group 3 and 4 had cancer, in group 2 only 10% had cancer while group 1 (the high selenium group) has a cancer incidence of 3%.

For Selenium's Sake



From: Selenium, as food and medicine. (What you need to know) 1980. Dr. Richard Passwater

One of the pioneers in selenium research was Dr. Schrauzer. Dr Schrauzer continued his research with animal experiments. One of his most impressive experiments was with a breed of mice that have a high occurrence of breast cancer. One group of mice had a normal diet with RDA (recommended daily allowance) of selenium. The experimental group had selenium added to the drinking water (2 parts per million). The follow up showed that while 82% of the control group experienced breast cancer, while the experimental group only had a 10% breast cancer rate. Furthermore, the tumors of the experimental group were “less malignant” and had a 50% increase survival time.



From: Selenium, as food and medicine. (What you need to know) 1980. Dr. Richard Passwater

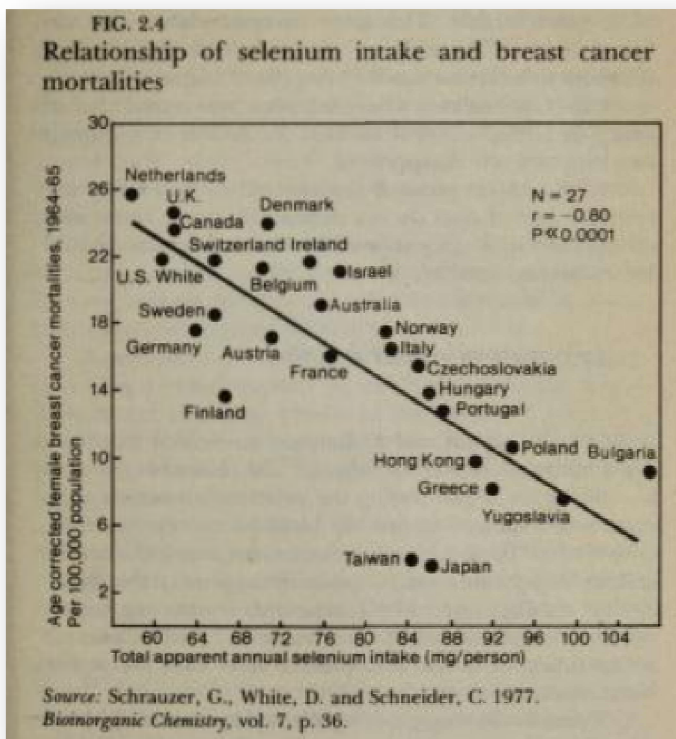
For Selenium's Sake

As more doctors and scientists became involved with selenium, the results were impressive. Selenium was seen as a prophylaxis against cancer. Warning were given to those living in areas with low selenium soil and those working in chemical and metal industries, as selenium protects against heavy metals and toxins.

"Selenium supplementation promises to become a method of cancer prophylaxis applicable at the individual or community level. Selenium supplementation is recommended particularly for individuals at high risk. This includes those with familial predisposition to cancer. Workers in the chemical and metal industries could also benefit from selenium supplementation."

Schrauzer and colleagues, during the Second International Conference on Inorganic and Nutritional Aspects of Cancer, La Jolla, California, 5 January 1979

Dr. Schrauzer collected selenium values from blood banks across the world. He noticed a correlation of low selenium blood levels and high rates of cancer. Dr Schrauzer calculated the average selenium intake and found a significant trend. Below is the graph of the relation between selenium intake and breast cancer (Dr. Schrauzer found similar numbers for leukemia, colorectal, lung, ovarian and prostate cancer).



From: Selenium, as food and medicine. (What you need to know) 1980. Dr. Richard Passwater

For Selenium's Sake

At about the same time as Dr. Schwartz, Dr. Shamberger was one of the first scientists who discovered low selenium blood levels in cancer patients compared to people without cancer. Dr. Shamberger found that while blood from normal people contained more than 18 microgram of selenium per 100 mll, cancer patients usually had between 12-15 micrograms. Dr. Shamberger furthered his research into soil and concluded that people who lived in area's that contained soils high in selenium had a lower cancer death rate. In the table below you can see the cancer rates in various areas and selenium concentration in human blood and cancer deaths in a variety of cities in the USA.

Selenium concentration in human blood and human cancer death rate in various cities (1962-66)

City	Blood Se (mcg/100 ml)	Cancer deaths per 100,000 pop.
Rapid City, S.D.	25.6	94.0
Cheyenne, Wyo.	23.4	104.0
Spokane, Wash.	23.0	179.0
Fargo, N.D.	21.7	142.0
Little Rock, Ark.	20.1	176.0
Phoenix, Ariz.	19.7	126.7
Meridian, Miss.	19.4	125.0
Missoula, Mont.	19.4	174.0
El Paso, Tex.	19.2	119.0
Jacksonville, Fla.	18.8	199.0
Red Bluff, Calif. (Tehama Co.)	18.2	176.0
Geneva, N.Y.	18.2	172.0
Billings, Mont.	18.0	138.0
Montpelier, Vt. (Wash. Co.)	18.0	164.0
Lubbock, Tex.	17.8	115.0
Lafayette, La.	17.6	145.0
Canandaigua, N.Y. (Ontario Co.)	17.6	168.0
Muncie, Ind.	15.8	169.0
Lima, Ohio	15.7	188.0

Source: Shamberger, R. and Willis, C. June 1971. *CRC Reviews*.

From: Selenium, as food and medicine. (What you need to know) 1980. Dr. Richard Passwater

Cancer death rates in various areas

Selenium level	(ppm) (soil)	No. states	Cancer death rate (per 100,000)
Very High	above 0.26	6	392
High	0.10 to 0.25	19	430
Medium	0.06 to 0.09	11	450
Low	0.01 to 0.05	20	516

The 1968 55-64 age-specific cancer death rate for the white males in states located in regions of selenium occurrence.

Source: Shamberger, R. May 11-13, 1976. From the *Proceedings of the symposium on selenium-tellurium in the environment*. Univ. of Notre Dame, p. 262.

From: Selenium, as food and medicine. (What you need to know) 1980. Dr. Richard Passwater

For Selenium's Sake

As scientists started to look worldwide, a trend started to be observed that selenium intake was lower in countries with a higher heart disease rate. Despite these observations, governments were not keen on improving conditions. Of the many countries deficient in selenium, the Finish government was one of the few governments that took action and started putting selenium into the soil (in 1985).

<i>Country</i>	<i>Heart Disease Rate</i>	<i>Selenium Intake¹</i>
Finland	1009	25
U.S.A.	870	61
Canada	722	62
Ireland	722	75
Great Britain	713	75
Australia	867	76
Norway	602	82
Greece	236	92
Poland	301	94
Yugoslavia	232	99
Bulgaria	331	108

The research featured heart disease deaths per 100,000 in 55 to 64-year-old men.

Selenium : the facts about this essential mineral by Lewis, Alan, Publication date 1982

What Does Selenium Do?

“Glutathione peroxidase has the distinction of being the only human enzyme known that requires the element selenium for its activity”

Current Status Review: Free radicals, reactive oxygen species and human disease: a critical evaluation with special reference to atherosclerosis

Tunnel vision is prominent in medical science and is no different in food research. This is a logical consequence of science as specializing is needed to derive conclusions. Science has a difficulty to see molecules as being multi-functional. In 1973, oxidative damage to red blood cells was associated with a selenium deficiency, and reduced activity of the enzyme glutathione peroxidase. Ever since the discovery that selenium is part of the detoxifying system glutathione peroxidase (GPx), the focus has been on GPx. Apart from being part of GPx, selenium has many more attributes. Selenium stimulates the immune system, protects against toxins, has mitochondria enhancing properties, and many more unknown effects. Selenium is incorporated into a variety of proteins (more than 100) for different functions.

Selenium and the Heart

In 1965, Godwin researched selenium deficiency and observed similarities in different species. Whether it was lambs, rats or mice, on a selenium deficient diet, the muscles were greatly affected. Godwin noted

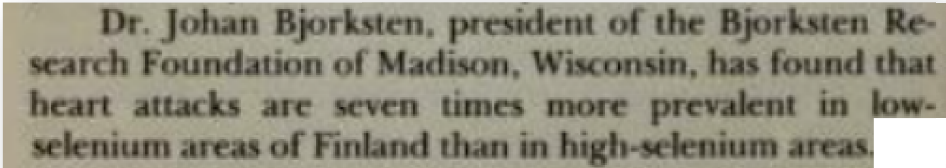
“The common denominator in selenium deficiency appears therefore to be alterations in the musculature.”

ABNORMAL ELECTROCARDIOGRAMS IN RATS FED A LOW SELENIUM DIET. By K. O. GODWIN. From the Division of Biochemistry and General Nutrition, Commonwealth Scientific and Industrial Research Organization, University of Adelaide, Adelaide, South Australia. (Received for publication 30th January 1965).

Since the heart is a muscle, selenium is very important for the heart. When a selenium deficiency in swine's was associated with mulberry heart disease, the connection with Keshan disease was quickly made. Keshan is caused by a selenium deficiency and is associated with an enlarged heart and poor heart function. A deficiency in selenium causes the increased expression of nitric oxide synthase, followed by increased levels of nitric oxide. High levels of nitric oxide are known to have delirious effects on the heart.

“Elevated nitric oxide levels may account for some of the pathophysiological effects of Se deficiency on the heart”

Gomez RM, Levander OA, Sterin-Borda L. Reduced inotropic heart response in selenium-deficient mice relates with inducible nitric oxide synthase. Am J Physiol Heart Circ Physiol. 2003 Feb;284(2):H442-8. doi: 10.1152/ajpheart.00560.2002. PMID: 12529255.

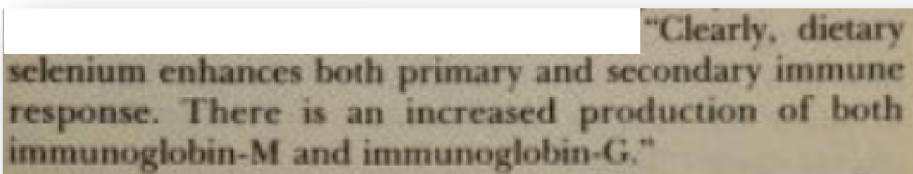


Dr. Johan Bjorksten, president of the Bjorksten Research Foundation of Madison, Wisconsin, has found that heart attacks are seven times more prevalent in low-selenium areas of Finland than in high-selenium areas.

From: Selenium, as food and medicine. (What you need to know) 1980. Dr. Richard Passwater

Selenium & Immunity

Selenium deficiency is known to cause an immune suppressive state. Early on farmers were quick to add selenium to feed to improve cattle conditions. It took many years before humans started thinking in terms of selenium and health. During the mid 1970s, research showed a better response to illness with selenium. A selenium deficiency can cause inactive lymphocytes, increase in the expression of adhesion molecules, defective neutrophils, and a general inability to kill ingested organisms.



"Clearly, dietary selenium enhances both primary and secondary immune response. There is an increased production of both immunoglobulin-M and immunoglobulin-G."

From: Selenium, as food and medicine. (What you need to know) 1980. Dr. Richard Passwater

"Adequate dietary selenium is essential for the activity of virtually all arms of the immune system. It is particularly significant that supplemental selenium can improve immune function in British individuals who consume diets that are considered adequate by World Health Organization (WHO) criteria but do not meet the British Recommended Daily Intake"

Immunity Enhanced by Trace Elements Selenium in the Immune System. John R. Arthur, Roderick C. McKenzie and Geoffrey J. Beckett. Rowett Research Institute, Bucksburn, Aberdeen. J. Nutr. 133: 1457S-1459S, 2003.

"The data indicate that these subjects had a functional selenium deficit with suboptimal immune status and a deficit in viral handling. They also suggest that the additional 100 microg Se/d may be insufficient to support optimal function."

Broome CS, McArdle F, Kyle JA, Andrews F, Lowe NM, Hart CA, Arthur JR, Jackson MJ. An increase in selenium intake improves immune function and poliovirus handling in adults with marginal selenium status. Am J Clin Nutr. 2004 Jul;80(1):154-62. doi: 10.1093/ajcn/80.1.154. PMID: 15213043.

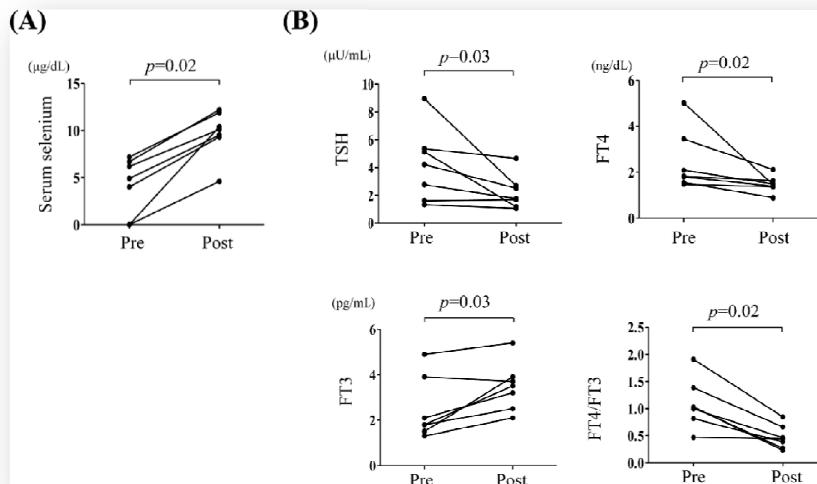
Selenium and Thyroid Function

A study from 2014 showed that selenium levels declined with age. The thyroid function also becomes less as we age, with typically less of the T3 (active thyroid hormone) and near enough equal of T4. One reason for a lessening of thyroid function is the reduction of T4 into T3. Selenium is part of the protein that converts the inactive thyroid hormone (T4) into the active thyroid hormone. These enzymes are called the iodothyronine deiodinases, and need selenium to function. Of the different enzymes, Iodothyronine 5' deiodinase is a key enzyme for conversion. Only during the mid 1990s was it demonstrated that selenium was part of the enzyme.

“We concluded that reduced peripheral T4 conversion is related to impaired Se status in the elderly”

Olivieri O, Girelli D, Stanzial AM, Rossi L, Bassi A, Corrocher R. Selenium, zinc, and thyroid hormones in healthy subjects: low T3/T4 ratio in the elderly is related to impaired selenium status. Biol Trace Elem Res. 1996 Jan;51(1):31-41. doi: 10.1007/BF02790145. PMID: 8834378.

During a 1995 study, iodothyronine 5'-deiodinase type I activity was noted in a control group and a selenium group in the elderly. The before and after results show that in the selenium group an increase in average T3, decrease in T4 and a decrease in TSH, while selenium levels increased.



“Changes in serum selenium and thyroid hormone levels following selenium supplementation in abnormal thyroid group of selenium-deficient patients. (A): Selenium levels were compared before and after selenium supplementation. (B): Serum thyroid stimulating hormone (TSH), free T4 (FT4), and free T3 (FT3) levels, and FT4/FT3 ratio were compared before and after selenium supplementation”

Olivieri O, Girelli D, Azzini M, Stanzial AM, Russo C, Ferroni M, Corrocher R. Low selenium status in the elderly influences thyroid hormones. Clin Sci (Lond). 1995 Dec;89(6):637-42. doi: 10.1042/cs0890637. PMID: 8549083.

Another way to check for thyroid health is to test for thyroid peroxidase autoantibodies (TPO). The presence of (TPO) antibodies in your blood suggests a condition of the thyroid, such as Hashimoto's disease or Graves' disease. A study in 2006 found that selenium intake

“Se supplementation during pregnancy and in the postpartum period reduced thyroid inflammatory activity and the incidence of hypothyroidism”

Negro R, Greco G, Mangieri T, Pezzarossa A, Dazzi D, Hassan H. The influence of selenium supplementation on postpartum thyroid status in pregnant women with thyroid peroxidase autoantibodies. J Clin Endocrinol Metab. 2007 Apr;92(4):1263-8. doi: 10.1210/jc.2006-1821. Epub 2007 Feb 6. PMID: 17284630.

Selenium And The Brain

During times of severe selenium deficiency, the brain is protected by hoarding selenium. If the brain is deficient in selenium, animal studies show that uptake of selenium in the brain can increase dramatically

“the injection of ⁷⁵Se-labeled Selenop caused five-time higher accumulation of ⁷⁵Se in the Se-depleted rat brain 2 h later than that in Se-sufficient animals”

Solovyev N, Drobyshev E, Blume B and Michalke B (2021) Selenium at the Neural Barriers: A Review. Front. Neurosci. 15:630016. doi: 10.3389/fnins.2021.630016

Supplementing selenium to children with seizures alleviates their conditions. Selenium counteracts the over production of the glutamate excitatory system, while a selenium deficiency can lead to impaired GABAergic neurons. Many observations are made of lower selenium levels in Alzheimer¹, while medicine containing selenium is helpful in cases of mild Alzheimer's²

“This result is reinforced in the lower antioxidant status subgroup. Subjects with low levels of selenium have an increased risk of cognitive decline”

Berr C, Balansard B, Arnaud J, Roussel AM, Alperovitch A. Cognitive decline is associated with systemic oxidative stress: the EVA study. Etude du Vieillissement Artériel. J Am Geriatr Soc. 2000 Oct;48(10):1285-91. doi: 10.1111/j.1532-5415.2000.tb02603.x. PMID: 11037017

Male Health And Selenium

Apart of the brain, selenium is very important for male health. Some studies show that up to 40% of selenium intake in males goes to the sex organs. Many studies show an inverse relationship between selenium intake and blood levels and prostate cancer.

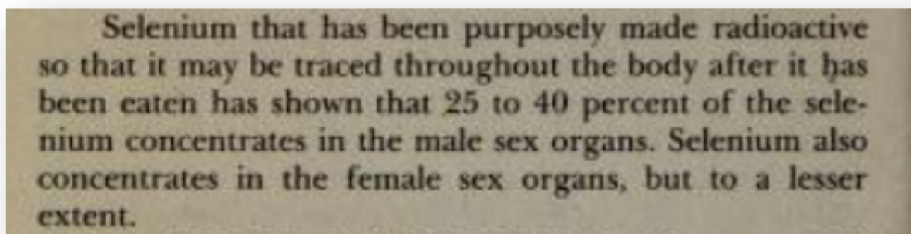
¹ González-Domínguez R, García-Barrera T, Gómez-Ariza JL. Homeostasis of metals in the progression of Alzheimer's disease. *Biometals*. 2014 Jun;27(3):539-49. doi: 10.1007/s10534-014-9728-5. Epub 2014 Mar 26. PMID: 24668390.

² Scheltens P, Kamphuis PJ, Verhey FR, Olde Rikkert MG, Wurtman RJ, Wilkinson D, Twisk JW, Kurz A. Efficacy of a medical food in mild Alzheimer's disease: A randomized, controlled trial. *Alzheimers Dement*. 2010 Jan;6(1):1-10.e1. doi: 10.1016/j.jalz.2009.10.003. PMID: 20129316.

“The risk of cancer for subjects in the lowest quintile of serum selenium was twice that of subjects in the highest. Multivariate adjustment for geographical area and serum levels of lipids, vitamins A and E, and carotene, did not alter this relation. The association between low selenium level and cancer was strongest for gastrointestinal and prostatic cancers.”

Willett WC, Polk BF, Morris JS, Stampfer MJ, Pressel S, Rosner B, Taylor JO, Schneider K, Hames CG. Prediagnostic serum selenium and risk of cancer. Lancet. 1983 Jul 16;2(8342):130-4. doi: 10.1016/s0140-6736(83)90116-2. PMID: 6134981.

Biomarkers for prostate cancer are lowered with selenium intake. One of the ways how selenium is protective is by binding with cadmium. Cadmium is heavily associated with prostate cancer and infertility.



Selenium that has been purposely made radioactive so that it may be traced throughout the body after it has been eaten has shown that 25 to 40 percent of the selenium concentrates in the male sex organs. Selenium also concentrates in the female sex organs, but to a lesser extent.

From: Selenium, as food and medicine. (What you need to know) 1980. Dr. Richard Passwater

While zinc is known to be important for men's health and increasing testosterone levels, selenium is relatively unknown. Zinc is known as a selenium antagonist, and can decrease its availability. Animal studies show that increasing selenium and zinc together in the diet increased testosterone and thyroid hormones.

“Present investigation has shown the beneficial effect of supplementation of Zn and Se on antioxidative status of seminal plasma which may provide better protection to spermatozoa from oxidative damage. Zn and Se supplementation improved testosterone, T3 and T4 in blood serum which may play a role in production of good quality semen”

Pankaj Kumar, Brijesh Yadav & Sarvajeet Yadav (2013) Effect of zinc and selenium supplementation on antioxidative status of seminal plasma and testosterone, T4 and T3 level in goat blood serum, Journal of Applied Animal Research, 41:4, 382-386, DOI: 10.1080/09712119.2013.783482

Looking at semen motility and trace minerals, selenium has a closer association than zinc. A 1988 study found that selenium content in semen increased more closely with sperm count, more normal forms and motility than zinc.

Table 3. Contents of selenium, zinc and rubidium in relation to other parameters (mean \pm SD) in human semen samples divided into groups according to their sperm counts

Parameters	Range of sperm count ($\times 10^6$ /ml)				
	0.1-4.9	5-19	20-39	40-99	100-249
Number of samples	15	32	35	61	31
Selenium content (ng/g)	31.1 \pm 10.4	43.0 \pm 12.3	42.2 \pm 16.4	51.2 \pm 14.5	68.6 \pm 17.4
Zinc content (μ g/g)	111 \pm 61	155 \pm 89	126 \pm 93	123 \pm 60	147 \pm 89
Rubidium content (μ g/g)	1.1 \pm 0.5	1.4 \pm 0.5	1.2 \pm 0.4	1.3 \pm 0.4	1.4 \pm 0.5
Sperm count ($\times 10^6$ /ml)	2.1 \pm 1.4	11.5 \pm 4.1	30.4 \pm 5.0	60.7 \pm 15.5	131.2 \pm 30.6
Motile sperm (%)	39.4 \pm 9.1	43.2 \pm 10.7	46.9 \pm 12.3	50.5 \pm 9.2	53.4 \pm 11.3
Avital sperm (%)	36.3 \pm 14.2	34.9 \pm 8.5	36.5 \pm 11.6	30.7 \pm 9.3	32.5 \pm 9.0
Normal forms (%)	22.9 \pm 11.1	24.8 \pm 12.3	37.6 \pm 13.0	41.8 \pm 12.8	48.4 \pm 12.0
Speed (sec/mm)	65.1 \pm 21.5	58.3 \pm 17.0	54.1 \pm 16.7	48.8 \pm 11.0	47.6 \pm 11.6
Fructose concentration (μ g/ml)	3020 \pm 800	2700 \pm 1070	2470 \pm 840	2560 \pm 1090	2160 \pm 990

International Journal of Andrology, 1988,11, pages 415-423 Selenium, rubidium and zinc in human semen and semen fractions D. BEHNE*, HILDEGARD GEBNER, GABRIELE WOLTERS and JANET BROTHERTON* Hahn-Meitner Institute Berlin and *Department of Gynaecological Endrocrinology, Sterility and Family Planning, Klinikum Steglitz of the Free University, Berlin, FRG

In 1998, 69 men with fertility issues were asked to participate in a selenium study. The 69 men were divided into 3 groups; group 1 was the control, group 2 was given selenium, while group 3 received selenium and vitamins A, C and E. After 3 months, there was no difference between the selenium and the selenium and the vitamin group, but there were differences between the selenium groups and the control group. The selenium groups were found to have increased sperm motility. More remarkable, within the selenium groups 5 men fathered a child, while 0 men fathered a child in the control group³. A 1984 study found that selenium

“A follow-up of 4.5 to 5 years after the initial assay of Se revealed that low semen Se levels (less than or equal to 35 ng/ml) were associated with male infertility”

Bleau G, Lemarbre J, Faucher G, Roberts KD, Chapdelaine A. Semen selenium and human fertility. Fertil Steril. 1984 Dec;42(6):890-4. PMID: 6500080.

“Selenium treatment was associated with a significant (63%) reduction in the secondary endpoint of prostate cancer incidence during 1983-93. There were 13 prostate cancer cases in the selenium-treated group and 35 cases in the placebo group”

Clark LC, Dalkin B, Krongrad A, Combs GF Jr, Turnbull BW, Slate EH, Witherington R, Herlong JH, Janosko E, Carpenter D, Borosso C, Falk S, Rounder J. Decreased incidence of prostate cancer with selenium supplementation: results of a double-blind cancer prevention trial. Br J Urol. 1998 May;81(5):730-4. doi: 10.1046/j.1464-410x.1998.00630.x. PMID: 9634050.

³ Scott R, MacPherson A, Yates RW, Hussain B, Dixon J. The effect of oral selenium supplementation on human sperm motility. Br J Urol. 1998 Jul;82(1):76-80. doi: 10.1046/j.1464-410x.1998.00683.x. PMID: 9698665.

Selenium and Female Health

Although selenium doesn't reach the female sex organs in the same extent as the male counterparts, selenium is equally important for women. Animal studies show that selenium is critical during pregnancy for increasing progesterone.

“Se supplementation did not affect the length of the estrous cycle, but it did increase the concentration of plasma progesterone in the estrous cycle (P<0.001). These results suggest the possibility that Se contributes to the progesterone production of corpus luteum”

Kamada H, Hodate K. Effect of dietary selenium supplementation on the plasma progesterone concentration in cows. J Vet Med Sci. 1998 Jan;60(1):133-5. doi: 10.1292/jvms.60.133. PMID: 9492375.

“Se supplementation during pregnancy and in the postpartum period reduced thyroid inflammatory activity and the incidence of hypothyroidism”

Negro R, Greco G, Mangieri T, Pezzarossa A, Dazzi D, Hassan H. The influence of selenium supplementation on postpartum thyroid status in pregnant women with thyroid peroxidase autoantibodies. J Clin Endocrinol Metab. 2007 Apr;92(4):1263-8. doi: 10.1210/jc.2006-1821. Epub 2007 Feb 6. PMID: 17284630

Selenium supplementation significantly decreased signs of postpartum depression⁴ and seem to protect against breast and ovarian cancer. Multiple studies show findings of lower selenium levels in women who have breast cancer.

“low blood Se concentration may be indicative of increased breast cancer risk.”

Schrauzer GN, Molenaar T, Mead S, Kuehn K, Yamamoto H, Araki E. Selenium in the blood of Japanese and American women with and without breast cancer and fibrocystic disease. Jpn J Cancer Res. 1985 May;76(5):374-7. PMID: 3924710.

“Such a result leads to the conclusion that determination of selenium in the blood could be used as a noninvasive diagnostic parameter in clinical assessment of malignant breast disease.”

Krsnjavi H, Beker D. Seleniumspiegel im Serum als diagnostischer Parameter bei Mammakarzinom [Serum selenium level as a diagnostic parameter in breast cancer]. Helv Chir Acta. 1992 May;59(1):231-4. German. PMID: 1526833.

“Our findings suggest that there is an inverse relationship between serum Se concentration and the incidence of human ovarian cancer”

⁴ Mokhber N, Namjoo M, Tara F, Boskabadi H, Rayman MP, Ghayour-Mobarhan M, Sahebkar A, Majdi MR, Tavallaie S, Azimi-Nezhad M, Shakeri MT, Nematy M, Oladi M, Mohammadi M, Ferns G. Effect of supplementation with selenium on postpartum depression: a randomized double-blind placebo-controlled trial. J Matern Fetal Neonatal Med. 2011 Jan;24(1):104-8. doi: 10.3109/14767058.2010.482598. Epub 2010 Jun 8. PMID: 20528216.

Das NP, Ma CW, Salmon YM. Serum selenium concentrations in ovarian cancer patients using a simplified fluorimetric procedure. Biol Trace Elem Res. 1986 Sep;10(3):215-22. doi: 10.1007/BF02795620. PMID: 24254396.

“The low serum Se level in patients with malignant ovarian tumors was probably the result of protective migration of Se from blood to the cancer tissue.”

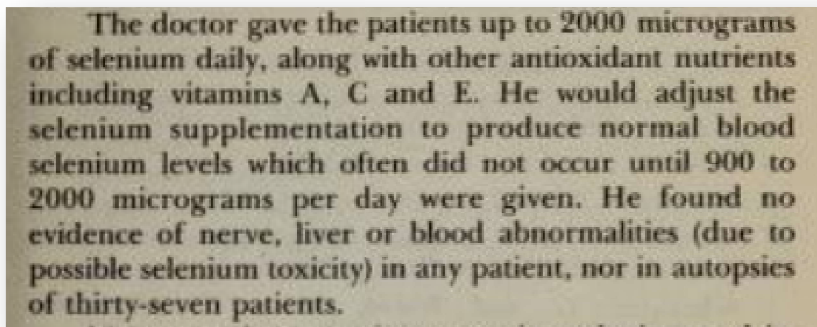
Xue FX, Zhang SW. [Selenium concentrations in serum, hair and tumor tissue from patients with ovarian tumors]. Zhonghua Fu Chan Ke Za Zhi. 1991 Sep;26(5):290-2, 323. Chinese. PMID: 1935410.

“Results showed that Zn, Cu, Se, Fe, Cu/Zn, Cu/Se, and Cu/Fe were present in different amounts in the serum of each of the three groups. Zn and Se levels were lower in the serum of the two tumor groups compared to the control group.”

Kuo HW, Chen SF, Wu CC, Chen DR, Lee JH. Serum and tissue trace elements in patients with breast cancer in Taiwan. Biol Trace Elem Res. 2002 Oct;89(1):1-11. doi: 10.1385/BTER:89:1:1. PMID: 12413046

How Much Selenium Should I Take Per Day?

This is an important question that has not been fully answered. Overall it can be stated that a deficiency is more easily achieved than an overdose (without supplementation). Even with supplementation up to 2000 micrograms of selenium (and other supplements), there were few, if any side-effects. One of the difficulties with selenium is that during sickness selenium intake is not always correlated with selenium blood levels.



The doctor gave the patients up to 2000 micrograms of selenium daily, along with other antioxidant nutrients including vitamins A, C and E. He would adjust the selenium supplementation to produce normal blood selenium levels which often did not occur until 900 to 2000 micrograms per day were given. He found no evidence of nerve, liver or blood abnormalities (due to possible selenium toxicity) in any patient, nor in autopsies of thirty-seven patients.

From: Selenium, as food and medicine. (What you need to know) 1980. Dr. Richard Passwater

The RDA for selenium is 55 microgram per day for adults, the World Health Organization advised 26 mcg for females and 34 mcg for males. This amount is, on average easily achieved in places like the USA. However these recommendations were made when polyunsaturated fatty acids were lower and soils had higher levels of selenium. Even 40 years ago, the maintenance balance for selenium was estimated at 1 gram per kg bodyweight.

“When balance and intake were adjusted for body weight, the sex difference disappeared, and both men and women needed about 1 microgram of dietary selenium per kg of body weight per day to maintain balance.”

Dietary selenium levels needed to maintain balance in North American adults consuming self-selected diets. Levander OA, Morris VC The American Journal of Clinical Nutrition, 01 May 1984, 39(5):809-815. DOI: 10.1093/ajcn/39.5.809 PMID: 6711484

This suggestion is for maintenance only and is not for optimal need. Beyond a variety within the individual requirements, the elderly, active people and even in normal situations, some might need more.

“The RDA does not, however, reflect the higher selenium intake that has been associated with reduced risk for cancer because the evidence for this effect was deemed insufficient”

Peters, Ulrike, and Yumie Takata. "Selenium and the prevention of prostate and colorectal cancer." *Molecular nutrition & food research* vol. 52,11 (2008): 1261-72. doi:10.1002/mnfr.200800103

“Despite concerns about the toxicity of higher dietary levels of selenium, humans consuming up to 600 µg of selenium daily appear to have no adverse clinical symptoms.....Therefore, it is concluded that the selenium requirement for maximum reduction of cancer appears to be at least four times the RDA”

Nutrition and cancer prevention / edited by Atif B. Awad, Peter G. Bradford. 2006

Since the RDA for adults is about 55 mcg, this would amount to about 220 mcg a day. Most scientist and researchers express the idea that optimal dose might be between 250-300 mcg

“Extradietary supplementation of selenium at the dosage of 200 micrograms per day is generally considered safe and adequate for an adult of average weight subsisting on the typical American diet.”

Nutritional selenium supplements: product types, quality, and safety. G N Schrauzer. 2001

Selenium toxicity is often mentioned in the literature. Reasons why toxicity is seen is often due to the historic use of selenite and extreme dosage. Safety levels of selenite are lower than organic selenium. Overdose with selenium can be easily achieved when high doses like 5 mg are used.

The fingernail changes and loss of hair are the main signs of excess selenium intakes. With excess selenium intakes, the fingernails become brittle and are easily cracked. A daily intake of nearly 5 mg of selenium resulted in definite occurrence of selenosis, characterized by hair and nail losses.’

Nutrition and cancer prevention / edited by Atif B. Awad, Peter G. Bradford. 2006

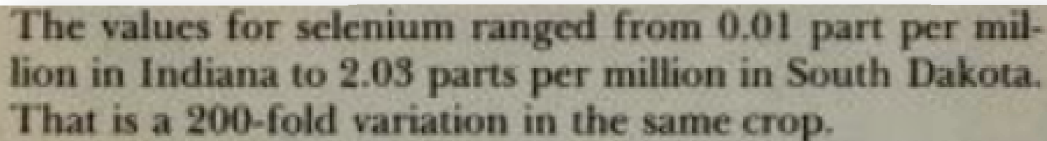
Why Calculating Selenium Intake Is Difficult

Selenium recommendations usually include some Brazil nuts and the selenium intake is covered. This is misleading as all selenium content in food sources depends on the soil. Even with Brazil nuts, selenium content is diverse. While Brazil nuts grown in the Amazon region is full of selenium, other regions in Brazil show Brazilian nuts with severely reduced selenium content. This reduction can be up to 95% less selenium.

“The median Se concentration in Brazil nuts varied from 2.07 mg kg⁻¹ (in Mato Grosso state) to 68.15 mg kg⁻¹ (in Amazonas state)”

Silva Junior EC, Wadt LHO, Silva KE, Lima RMB, Batista KD, Guedes MC, Carvalho GS, Carvalho TS, Reis AR, Lopes G, Guilherme LRG. Natural variation of selenium in Brazil nuts and soils from the Amazon region. Chemosphere. 2017 Dec;188:650-658. doi: 10.1016/j.chemosphere.2017.08.158. Epub 2017 Sep 4. PMID: 28923728.

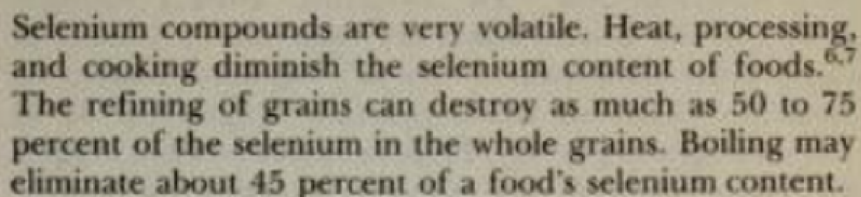
This is not just for Brazil nuts but for all foods, rye from the USA on average has 0.080 mg/kg, rye from Finland only contains 0.004 mg/kg, the same goes for wheat, wheat from Canada contains 1.300 mg/kg while wheat from China (in some area's) only contains 0.0196 mg/kg, that is almost 70 times less selenium.



The values for selenium ranged from 0.01 part per million in Indiana to 2.03 parts per million in South Dakota. That is a 200-fold variation in the same crop.

From: Selenium, as food and medicine. (What you need to know) 1980. Dr. Richard Passwater

Another difficulty about calculating selenium intake is the cooking method. Boiling, roasting and processing all decrease selenium content in food. Although many people get most of their selenium intake from grains, the refining of grains can destroy as much as 75% of selenium. As selenium binds with toxins, high toxin foods decrease selenium assimilation.

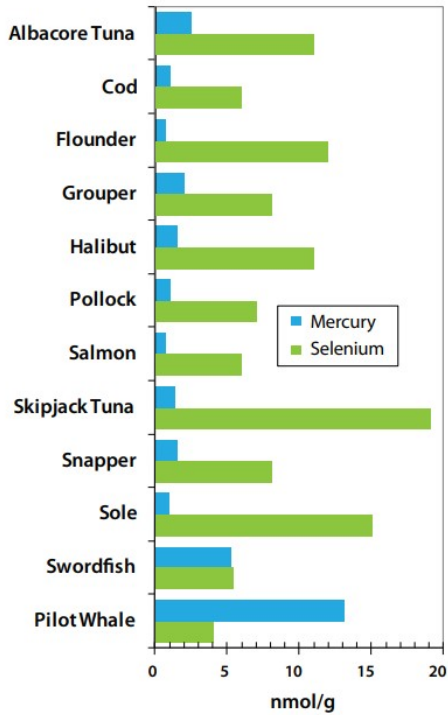


Selenium compounds are very volatile. Heat, processing, and cooking diminish the selenium content of foods.^{6,7} The refining of grains can destroy as much as 50 to 75 percent of the selenium in the whole grains. Boiling may eliminate about 45 percent of a food's selenium content.

From: Selenium, as food and medicine. (What you need to know) 1980. Dr. Richard Passwater

For Selenium's Sake

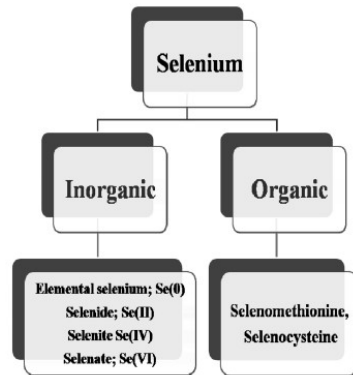
Seafood usually contains a good amount of selenium. Some of the selenium in seafood can't be used. Selenium is used to tolerate the high degree of polyunsaturated fatty acids (PUFA) in seafood. Furthermore, the toxins in seafood are bound to selenium and also can't be used. Some studies show that the selenium intake with fish is needed to offset the potential harm from the mercury intake. Below is a list of different fish with their selenium and mercury content.



Selenium and Mercury, Fishing for Answers. <https://www.noaa.gov/>

Inorganic Vs Organic

The initial animal studies focused on selenite (an inorganic form of selenium). Even though inorganic forms of selenium showed benefits, toxicity is more easily achieved. Most studies showing adverse and toxic effects used the inorganic forms of selenium. These forms are usually selenium with sodium or some other mineral. Selenium in organic form is usually incorporated into the amino acids methionine and cystine. Inorganic selenium is an ion and needs 2 electrons to fulfill the octet rule (eight electrons in its valence shell).



Flora, Swaran. (2015). Preventing Fluoride Toxicity with Selenium

“In conclusion, Se supplementation improved the parameters of buffalo bull semen and more precisely, organic Se was more effective for the improvement of semen quality and some blood components than inorganic Se.”

El-Sharawy M, Eid E, Darwish S, Abdel-Razek I, Islam MR, Kubota K, Yamauchi N, El-Shamaa I. Effect of organic and inorganic selenium supplementation on semen quality and blood enzymes in buffalo bulls. Anim Sci J. 2017 Jul;88(7):999-1005. doi: 10.1111/asj.12736. Epub 2016 Nov 21. PMID: 27868316.

“Organic compounds of selenium are more effective in comparison with inorganic compounds. Selenium as selenomethionine has nearly twice the bioavailability of selenium as selenite”

Physiol. Res. 61 (Suppl. 1): S19-S34, 2012 REVIEW Biological Effects of Selenium Compounds With a Particular Attention to the Ontogenetic Development I. OŠŤÁDALOVÁ

“Current evidence favors selenomethionine over the other forms of selenium. Extradietary supplementation of selenium at the dosage of 200 micrograms per day is generally considered safe and adequate for an adult of average weight subsisting on the typical American diet”

Schrauzer GN. Nutritional selenium supplements: product types, quality, and safety. J Am Coll Nutr. 2001 Feb;20(1):1-4. doi: 10.1080/07315724.2001.10719007. PMID: 11293463.

The Problem With PUFA

Intensive farming has reduced the average intake of selenium. This reduced intake of selenium becomes worse as both toxins and polyunsaturated fatty acids are increased. One of the attributes of selenium is its ability to reduce toxin overexposure. Selenium removes cadmium, mercury and lead; this however comes with a cost. The cost will be the loss of selenium.

Another huge cause for both the loss of selenium and an increased need for selenium are the PUFA's. Selenium, as part, of GPx is needed to protect tissues against free radicals. GPx is actively lowering the hydroperoxides in the cell. Hydroperoxides are inflammatory properties that are always being created. In a normal organism (with enough selenium) GPx can handle normal stressors and keep hydroxides within a normal range.

In the 1940s, a vitamin E deficiency was seen by some scientists as the same as a cod liver oil or rancid fat diet⁵. Shortly after these observations, the same was found with diet free of selenium. The brain was particularly fragile if vitamin E and selenium were withheld. Encephalomalacia in chicks was

“characterized by uncoordinated movements of the legs, wings, and neck. The chicks would fall when trying to walk, and occasional tremors would”

THE RELATIONSHIP OF VITAMIN E TO PITUITARY GLAND FUNCTION by MILTON RICHARD SNOW B.S., York College, York, Nebraska, 1949

Some observations were made that showed the importance of selenium. Scientists found that encephalomalacia was never observed if polyunsaturated fats were withheld; furthermore, the symptoms of encephalomalacia could be prevented by giving selenite

“To our knowledge, encephalomalacia has never been observed with diets not containing polyenoic fatty acids and this symptom is not prevented by ‘Selenite’”

DAM, H., NIELSEN, G., PRANGE, I. et al. Nature (1958) 182: 802. doi:10.1038/182802a0

During the same time researchers speculated the increase of vegetable oils could do serious harm and overburden the system when vitamin E was insufficient⁶. About 20-30 years later scientists wondered whether the same would be true for selenium as it is for vitamin E. Selenium increases vitamin E in the body and increases its activity. As selenium is needed to stop the excess of free radical damage, more intake of PUFA requires more selenium.

⁵ Vitamin E, cod liver oil and muscular dystrophy. Author(s) : MATTILL, H. A.; GOLUBIC, C.
Author Affiliation : Biochem. Labs., State Univ. Iowa, Iowa City. Journal article : Journal of Nutrition 1942
Vol.23 pp.625-631

⁶ FISHERIES RESEARCH BOARD OF CANADA Translation Series No. 621
On the relationships between vitamin E • and polyunsaturated fatty acids By Professor Dr. H. 'Dam
Original title: Vber die Beziehungen zwischen Vitamin E und mehrfach ungesättigten Fettsäuren
From: Fette-Seifen-Anstrichmittel, Vol. 66, No. 11, pp. 899-903, 1964.

Free radicals are produced by several processes in the body. The healthy body normally can neutralize the self-produced free radicals before an excessive rate of damage occurs. However, polyunsaturated fatty acids form highly reactive self-propagating free radicals when initiated by a "starter" free radical. Whenever the intake of polyunsaturated fatty acids greatly exceeds that necessary for function, the risk of lipid peroxidation increases, as does the probability of cancer unless protected by additional antioxidants.

From: Selenium, as food and medicine. (What you need to know) 1980. Dr. Richard Passwater

The Problem With Fish Oil

Although a potent source of selenium, fish has a high content of the omega 3 fatty acids. Selenium is important for fish as selenium can keep lipid peroxidation in check. Research has shown that fish low in selenium have serious immune issues. The decrease of glutathione can up regulate lipid peroxidation and can result in a loss of selenium. Selenium can be released from the glutathione peroxidation molecule by loss of integrity caused by fish oil supplementation. Scientists recommend checking the selenium status of patients before suggesting increasing PUFA intake.

“following fish oil intake, can generate increased amounts of lipid peroxides and thus allosterically activate GSH-Px: with time this is harmful for the integrity of the enzyme molecule and Se release may result. We suggest that the Se status of individuals given PUFAs is assessed before and during intake; Se supplements should only be given when serum and/or erythrocyte Se are reduced”

Selenium and glutathione peroxidase variations induced by polyunsaturated fatty acids oral supplementation in humans. G Bellisola, S Galassini, G Moschini, G Poli, G Perona, G Guidi 1992

Due to the loss of selenium by fish oils, fish oils could have an overall negative effect. One study found that fish consumption increased 5 times more in selenium values than fish oil absorption. Selenium has many of the positive factors attributed to fish oil (anti-inflammatory, brain healthy). Fish oils manufacturers make use of the healthy attributes by adding selenium (and vitamin E) into the fish oil.

“fish consumption explained only 2.6% of the variance in RBC omega3 FAs (6.2% for omega6) but as much as 15% of the variance in plasma selenium”

Berr C, Akbaraly T, Arnaud J, Hininger I, Roussel AM, Barberger Gateau P. Increased selenium intake in elderly high fish consumers may account for health benefits previously ascribed to omega-3 fatty acids. J Nutr Health Aging. 2009 Jan;13(1):14-8. doi: 10.1007/s12603-009-0003-3. PMID: 19151902.

For more information visit www.fishybusiness.site