

ORIGINAL ARTICLE

Prevalence of Selenium Deficiency Hypothyroidism instead of Iodine Deficient hypothyroidism in Malwa Belt of Punjab due to intake of highly nitrogen fertilized food: A case study of Sri Muktsar Sahib district of Punjab

Seema Goyal

Ex- District Epidemiologist, Sri Muktsar Sahib, Punjab, India

CORRESPONDING AUTHOR

Dr Seema Goyal, Ex - District Epidemiologist, Sri Muktsar Sahib, Punjab, India-152026

Email: seemlectures726@gmail.com

CITATION

Goyal S. Prevalence of Selenium Deficiency Hypothyroidism instead of Iodine Deficient hypothyroidism in Malwa Belt of Punjab due to intake of highly nitrogen fertilized food: A case study of Sri Muktsar Sahib district of Punjab. Journal of the Epidemiology Foundation of India. 2025;3(3):270-276. DOI: <https://doi.org/10.56450/JEFI.2025.v3i03.007>

ARTICLE CYCLE

Received: 17/06/2025; Accepted: 12/09/2025; Published: 30/09/2025

This work is licensed under a Creative Commons Attribution 4.0 International License.

©The Author(s). 2025 Open Access

ABSTRACT

In Muktsar district of Punjab state, Hypothyroidism cases has increased suddenly in last 2 decades when desired iodine concentration in water is 15-40 ppm and Muktsar district water has 16 ppm of iodine. Iodine deficiency is considered as cause of hypothyroidism conventionally. For conversion of T₄ to T₃ hormone, selenoenzymes plays an important role which was disturbed due to intake of highly nitrogenous food products. One of the objective of study was to study the socio-demographic variables of sample patients and other to find out comparison between the effectiveness of organic selenium supplement (wheat grass) and hypothyroid drugs on patients with selected socio demographic variables and last to assess the effectiveness of organic selenium supplement (wheat grass) along with hypothyroid drug eltroxin on patients with hypothyroidism due to intake of urea via crops. To achieve the objectives of the study, primary data were collected from 140 patients selected from Sri Muktsar Sahib district of Punjab. The study revealed that on giving organic selenium with eltroxin in experimental group improvement was nearly 2.6 times more than eltroxin alone in non – experimental group. The secondary hypothyroidism reported in non –experimental group (only eltroxin) was 4.6 times more than experimental group (organic selenium with eltroxin). It was further evaluated from the study that uric acid production increases with the intake of nitrogenous food products. As a result more selenoenzymes are consumed in the body for elimination of nitrogenous waste as uric acid which further affect thyroid gland metabolism. There are raised chances of selenium deficiency hypothyroidism instead of iodine deficiency hypothyroidism.

KEYWORDS

Hypothyroidism, Selenium deficiency, Iodine deficiency

INTRODUCTION

Thyroid gland plays crucial role in regulating metabolism in human body. It is situated in

front of wind pipe between cartilages C₃ to C₆. The thyroid axis plays a vital role in regulating cellular differentiation and metabolism in

almost all nucleated cells in the body (1). The disorders of thyroid functions have diverse manifestations. Signs and symptoms of hypothyroidism are dry coarse skin, bradycardia, myxedema, hair loss, , swelling of limbs and pleural infusion, exhaustion, weakness and [fatigue](#), low [pulse](#), Sensitivity to cold and reduced sweating, Slight to moderate weight gain, [Constipation](#), dry [skin](#) and hair loss(2). Selenium is the main element of family of monodeiodinase enzymes, also known as selenoenzymes (3). T₃ is formed from T₄ by action of selenoenzyme Iodothyronine Deiodinases (4).

$T_4 \text{Iodothyronine Deiodinases} \rightarrow T_3$

A research work has confirmed difference among spinach genotypes in terms of efficiency in nitrogen use and oxalate and nitrate accumulation. Spinach accumulated much more nitrate in oxalate in blade indicating that nitrate and oxalate increase in cells after putting high quantity of N fertilizers (5). Purines are basic unit of DNA along with pyrimidines. As purine metabolism increases in body, the uric acid (C₅H₄N₄O₃) is produced as by product in humans as their uricotelic organism and excretes uric acid. Normal value of uric acid is 3.5-6.0 mg/dl in humans. When cell dies and recycle, the purine in their genetic material also get broken down. Due to consumption of high nitrogen food purine molecules formation increases in body. Our body produces uric acid from breakdown of purines normally (6,10). Uric acid serves as an antioxidant and prevents damage to blood vessels lining. On the other hand, high level of uric acid in blood and other parts of body can cause many health problems like as if uric acid accumulate, uric acid crystals (also called monosodium urate crystal) deposit in our tendon, joints, kidneys and other organs. This accumulation of uric acid is called gouty arthritis or simply gout(7).

Proxanthine Xanthine oxidase

$\rightarrow \text{Xanthine} \rightarrow \text{Uric acid}$

Kidney excretes uric acid but 50% of uric acid is reabsorbed by loop of henle(8). Hence uric acid concentration is also increased in our body due to consumption of highly fertilized food (5,10). Selenium also helps in metabolism of uric acid by action of xanthine oxidases enzymes. In our

body there are limited selenoproteins. These molecules act in many metabolism like thyroid, uric acid, metabolism and reproduction etc(15). Due to increase in purine in body after taking high nitrogenous food, large proportion of selenoprotein diverted towards formation of uric acid (10,12,16) hence thyroid function is compromised due to deficiency of sufficient selenoproteins.(17)

As a result T₄ to T₃ conversion is blocked. When T₄ level increases, the T₃ level is decreased, body sent signal to pituitary gland to release more TSH. As a result selenium deficient hypothyroidism occur

MATERIAL & METHODS

Study Type & Study Design- Cross-sectional study on hypothyroidism patients the effectiveness of organic selenium supplement (wheat grass) along with hypothyroid drug eltroxin on patients with hypothyroidism due to intake of urea via crops

Study Setting- In Primary health centre, sri Muksar sahib by clinical assessment and lab report collection.

Study Population- Hypothyroidism patients aged 18-70 years.

Study Duration- Data pertains to 2021-22, duration of 3 months for each patients between 2 reports of hypothyroidism.

Sample Size Calculation- 140 patients (70 each group).

Inclusion Criteria- Patients aged 18-70 years with hypothyroidism.

Exclusion Criteria- Pregnant women, Age above 70 years, patients without clinical history/symptoms of hypothyroidism and patients already on medication for drugs affecting thyroid status

Strategy for Data Collection- Pre-tested schedule, lab reports of T₃, T₄, TSH collected. Ethical Issues & Informed Consent taken from patients

Data Analysis – Software- All the data collected were entered and analyzed in Statistical Package of Social Sciences (SPSS) version 16. Descriptive analysis was carried out to determine frequencies and proportions of categorical variables like various types of hyperthyroidism, gender group and age groups. Mean value and Standard Deviation

was also calculated for TSH, T3 and T4 hormones. The graphs were constructed using Microsoft Excel Programme.

Flow Diagram- 140 patients enrolled
 - Group 1 (n=70): Eltroxin (50-200 mcg)
 - Group 2 (n=70): Eltroxin (50-200 mcg) + organic selenium (wheat grass)
 - Duration: 3 months for every patient.

RESULTS

To find out comparison between the effectiveness of organic selenium supplement (wheat grass) and hypothyroid drugs on patients with selected socio demographic variables.

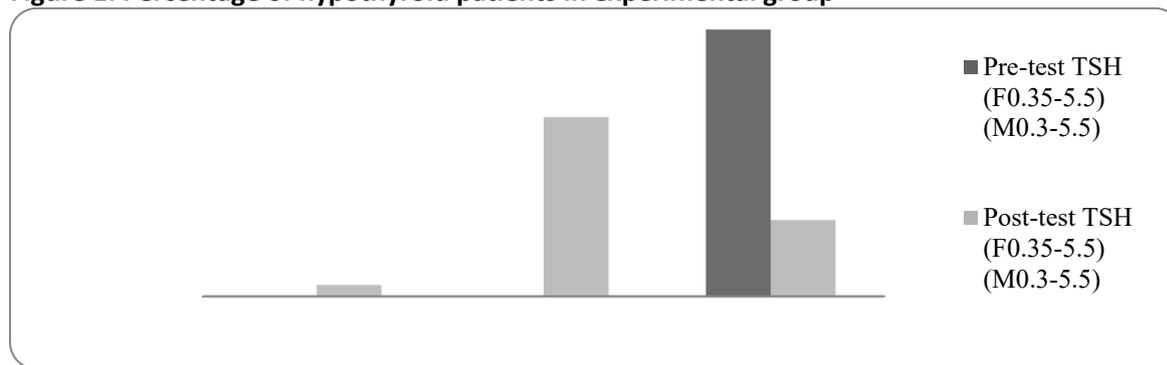
Table 1: Frequency and percentage Distribution of Selected Socio-Demographic Variables of patients

Particulars		Frequency	Percentage	Chi-square	df
Age (years)	20-30	30	21.4	76	39
	30-40	47	33.6		
	40-50	31	22.1		
	50-60	26	18.6		
	60-70	6	4.3		
Gender	Male	24	17.1	60.45	1
	Female	116	82.9		
Religion	Hindu	77	55.0	1.4	1
	Sikh	63	45.0		
Diet	Vegetarian	110	78.6	45.71	1
	Non-vegetarian	30	21.4		
Occupation	Farmer	4	2.9	126.64	4
	Employee	31	22.1		
	Businessman	18	12.9		
	Housewife	78	55.7		
	Student	9	6.4		
Marital status	Married	129	92.1	218.75	2
	Unmarried	10	7.1		
	Divorced/Separated	0	0.0		
	Widow/Widower	1	0.7		
Residence	Rural	18	12.9	65.83	1
	Urban	122	87.1		
Uric acid	Yes	52	37.1	9.25	1
	No	88	62.9		
Aware of organic food	Yes	83	59.3	4.83	1
	No	57	40.7		

Table 2: Comparison between Pre-test & Post-test hypothyroid patients by taking organic selenium supplement (wheat grass) along with hypothyroid drug eltroxin(experimental group)

Particulars	Pre-test			Post-test		
	T3 (F60-181) (M60-200)	T4 (F5.01-12.54) (M4.5-12.0)	TSH (F0.35-5.5) (M0.3-5.5)	T3 (F60-181) (M60-200)	T4 (F5.01-12.54) (M4.5-12.0)	TSH (F0.35-5.5) (M0.3-5.5)
Below normal range	6 (8.57)	8 (11.43)	-	2 (2.85)	16 (22.86)	3 (4.29)
Normal range	62 (88.57)	56 (80)	-	67 (95.71)	46 (65.71)	47 (67.14)
Above normal range	2 (2.85)	6 (8.57)	70 (100)	1 (1.43)	8 (11.43)	20 (28.57)

Figure 1: Percentage of hypothyroid patients in experimental group



The given bar graph (Figure 1) depicts information about the effectiveness of organic selenium supplement (wheat grass) along with hypothyroid drug eltroxin on patients with hypothyroidism due to intake of urea via crops during 2021-2022.

Table-3: Comparison of pre-test and post-test mean and standard deviation among hypothyroid patients in experimental group

Particulars	Mean	Standard Deviation	t-value	Df
Pre-Test	16.75	21.13	-	69
Post-Test	6.16	7.86	4.72*	

*indicates the 5per cent level of significance

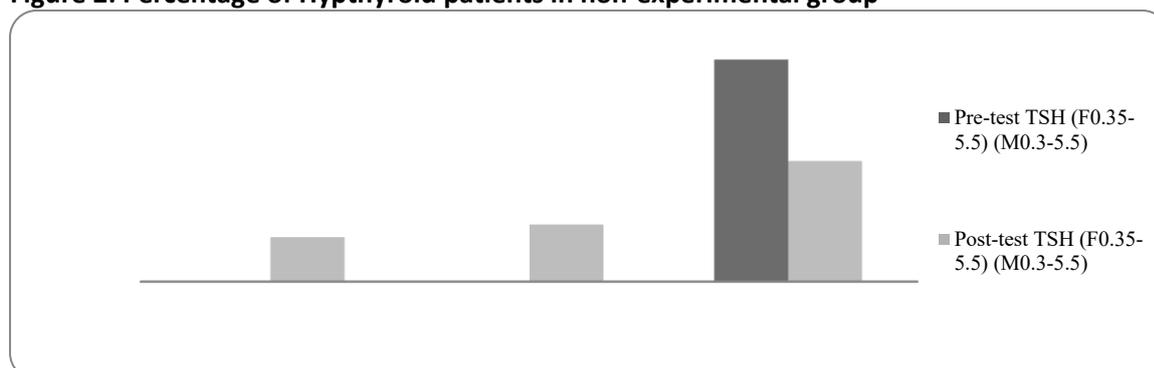
(Table 3)

The persual of Table 3 revealed that comparison of pre-test TSH of hypo-thyroid patients with mean value of 16.75 and standard deviation was 21.13 and of post-test TSH of hypo-thyroid patients with mean value of 6.16 and standard deviation was 7.86. Paired t-test value was applied to compare pre and post test TSH mean and standard deviation of thyroid patients and calculated paired t-test value was -4.72. The results indicated that there was significant reduction in value of TSH after giving organic selenium along with eltroxin to hypo-thyroid patients during year 2021-22.

Table 4: Comparison between Pre-test & Post-test hypothyroid patients by taking hypothyroid drug eltroxin only (Non-experimental group)

Particulars	Pre-test			Post-test		
	T3 (F60-181) (M60-200)	T4 (F5.01-12.54) (M4.5-12.0)	TSH (F0.35-5.5) (M0.3-5.5)	T3 (F60-181) (M60-200)	T4 (F5.01-12.54) (M4.5-12.0)	TSH (F0.35-5.5) (M0.3-5.5)
Below normal range	5 (7.14)	4 (5.71)	-	-	5 (7.14)	14 (20)
Normal range	64 (91.43)	60 (85.71)	-	66 (94.28)	59 (84.29)	18 (25.71)
Above normal range	1 (1.43)	6 (8.57)	70 (100)	4 (5.71)	6 (8.57)	38 (54.29)

Figure 2: Percentage of Hypthyroid patients in non-experimental group



As it is apparent from the bar graph , eltroxin drug alone (without selenium supplement) is less effective on patients with hypothyroidism due to intake of urea via crops during 2021-22 in same time range of experiment.

Table-5: Comparison of pre-test and post-test mean and standard deviation among thyroid patients in non-experimental group

Particulars	Mean	Standard Deviation	t-value	df
TSH	32.34	47.71	-	69
OTSH	7.47	13.88	5.31*	

*indicates the 5per cent level of significance

The persual of Table 5revealed that comparison of pre test TSH of hypo-thyroid patients with mean value of 32.34 and standard deviation was 47.71 and post test TSH of hypo-thyroid patients with mean value of 7.47 and standard deviation was 13.88. Paired t-test value was applied to compare pre and post test TSH mean and standard deviation of thyroid patients and calculated paired t-test value was -5.31. The results indicated that there was significant reduction in value of TSH after giving organic selenium along with eltroxin to hypo-thyroid patients during year 2021-22.

DISCUSSION

As it is apparent from bar graph the percentage of hypothyroid patients in experimental group TSH value below normal range and in normal range was 0 percent initially and the percentage increased up to 4.29 percent and 67.14 percent after giving eltroxin along with organic selenium but TSH value above normal range was 100 percent initially and declined to 28.57 percent after treatment.

On the other hand in non-experimental group the TSH value of hypothyroid patients below normal and in normal range was both 0 percent initially and increased to 20 percent and 25.71 percent after giving eltroxin only, whereas percentage of patients above normal range was 100 percent initially and declined to 54.29 percent.

On comparison of both experimental and non-experimental group the percentage of patients with normal TSH was 41.43 percent than the non-experimental group. But the percentage

of patients with TSH below normal range secondary hyper thyroidism in non-experimental group was 15.71 percent more than the experimental group

The normal prevalence of primary hypothyroidism is 1:100. But in Punjab, there is high increase in hypothyroidism, high uric acid, low reproduction and high cancer prevalence since 2001, which needs scientific research and attention immediately. According to me, Both of these factors high urea intake in food and selenoenzymes imbalance is responsible for increased hypothyroid cases in Punjab. In Sri Muktsar Sahib District of Punjab, people are eating food fertilized with synthetic nitrogenous fertilizer. normal use of N P K (nitrogen phosphorus potassium) fertilizer should be 100 kg/ha but is being used upto 300 -700 kg/ha (3-7 times) in last 20 years in Muktsar area. As we known nitrogen is essential component of plant growth and place a vital role in development of healthy foliage. On the other side increasing yield of crop (cereals, pulses, vegetables and fruits) by high quantity of fertilizers has disturbed the nitrogen balance of body.

SUGGESTIONS

Combination therapies and even fixed drug combination seem logical in several clinical situations. One common example is difficult to treat diseases and combination therapy is already considered the standard of care of conditions for hepatitis like c other condition include there one drug in combination potentiates the effect of other e.g. trimethoprim and sulphamethoxazole.A very High dose of eltroxin leads to hyperthyroidism in 20 percent patients. Effectiveness of eltroxin can be smooth, reduce doses and with minimal side effects taken along with organic selenium (not elemental selenium).

CONCLUSION

According To our study modern hypothyroidism problems in this area are occurring due to selenium deficiency secondary to excess nitrogenous intake. This hypothyroidism cannot be corrected or prevented by adding iodine to salt but can be

corrected by reducing high nitrogenous intake or by increasing natural selenium in diet. Study has explored. The study found that organic selenium to eltroxin treatment improved hypothyroidism outcome is 2.6 times more than eltroxin alone in hypothyroidism patients. Secondary hypothyroidism was 4.6 times lower with selenium supplementation. The study concludes that adding organic selenium to eltroxin significantly improves outcomes in these patients.

RECOMMENDATION

I strongly recommend to do deep study in this topic to find causes of hypothyroidism with perfect scientific lenses and help the people prevention and cure in more authentic way. As it is big whistle blowing challenging an established cause of iodine deficiency hypothyroidism.

LIMITATION OF THE STUDY

Unavailability of testing of selenium concentration of food and selenium concentration in body.

RELEVANCE OF THE STUDY

Earlier hypothyroidism was related to iodine deficiency only. Hypothyroidism related goiter is usually found in mountain areas in India. As iodine concentration in hilly areas is less than 14 ppm. As the WHO recommendation is to have a concentration of 15 to 40 ppm of iodine in salt at the household level (Third Edition, WHO, Geneva, 2007). In study area of Punjab, the iodine concentration is 16 ppm in water. Study indicates selenium deficiency hypothyroidism instead of iodine deficiency hypothyroidism

FINANCIAL SUPPORT AND SPONSORSHIP

Nil

CONFLICT OF INTEREST

There are no conflicts of interest.

DECLARATION OF GENERATIVE AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The authors haven't used any generative AI/AI assisted technologies in the writing process.

REFERENCES

- Hall JE, Hall ME. Guyton and Hall textbook of medical physiology. 14th ed. Philadelphia, Pa: Elsevier; 2020. 907-916
- Barrett KE, Barman SM, Brooks HL, Jason, Ganong WF. Ganong's review of medical physiology. New York: Mcgraw-Hill Education ; London; 2019.
- Gouriprasanna Roy, Bani Kanta Sarma, Prasad P Phadnis And G Muges (2005) Selenium-containing enzymes in mammals: Chemical perspectives. *India J. Chem. Sci.* **117** (4). 287–303.
- Brown KM, Arthur JR. Selenium, selenoproteins and human health: a review. *Public Health Nutr.* 2001;4(2):593–9.
- Stagnari F, Di Bitetto V, Pisante M. Effects of N fertilizers and rates on yield, safety and nutrients in processing spinach genotypes. *Sci Hortic.* 2007;114(1):30–8.
- Berliner RW, Hilton JG, Yu TF, Kennedy TJ. The renal mechanism for urate excretion in man. *J Clin Invest.* 1950;29(4):396–401.
- Wang G. *PLoS One.* 2014;9(12):e114579. See LC, Kuo CF, Yu KH, Luo SF, Chou IJ, Ko YS, Chiou MJ, Liu JR. Hyperthyroid and hypothyroid status was strongly associated with gout and weakly associated with hyperuricaemia. *PLoS One.* 2014;9(12):e114579
- Brown J, Mallory GK. Renal changes in gout. *N Engl J Med.* 1950;243(9):325–9.
- Reilly C. Selenium. A new entrant into the functional food arena. *Trends Food Sci Technol.* 1998;9:114–8.
- Choi HK, Liu S, Curhan G. Intake of purine-rich foods, protein, and dairy products and relationship to serum levels of uric acid: the Third National Health and Nutrition Examination Survey. *Arthritis Rheum.* 2005;52(1):283–9.
- Ristić-Medić D, Dullemeijer C, Tepsić J, Petrović Oggiano G, Popović T, Arsić A, et al. Systematic review using meta-analyses to estimate dose-response relationships between iodine intake and biomarkers of iodine status in different population groups. *Nutr Rev.* 2014;72(3):143–60.
- Tilman D. The greening of the green revolution. *Nature.* 1998;396:211–2.
- Elwyn D, Sprinson DB. The role of serine and acetate in uric acid formation. *J Biol Chem.* 1950;184(2):465–74.
- Friedman M, Byers SO. Increased renal excretion of urate in young patients with gout. *Am J Med.* 1950;9(1):31–4.
- Brown K, Arthur J. Selenium, selenoproteins and human health: a review. *Public Health Nutrition.* 2001 Apr;4(2b):593–9.
- Combs GF. Importance of selenium in human nutrition. In: Euroola M, editor. *Agrifood Research Report 69: Proceedings, Twenty Years of Selenium Fertilization; 2005 Sept 8–9; Helsinki, Finland.* Helsinki: Agrifood Research; 2005. p. 69–108.
- Wang G. *PLoS One.* 2014;9(12):e114579. See LC, Kuo CF, Yu KH, Luo SF, Chou IJ, Ko YS, Chiou MJ, Liu JR. Hyperthyroid and hypothyroid status was strongly

- associated with gout and weakly associated with hyperuricaemia. *PLoS One*. 2014;9(12):e114579
18. Gutman AB, Yu TF. Effects of adrenocorticotrophic hormone (ACTH) in gout. *Am J Med*. 1950;9(1):24–30.
 19. Hellman L. Production of acute gouty arthritis by adrenocorticotropin. *Science*. 1949;109(2829):280–1.
 20. Goldner WS, Sandler DP, Yu F, Shostrom V, Hoppin JA, Kamel F, et al. Hypothyroidism and pesticide use among male private pesticide applicators in the agricultural health study. *J Occup Environ Med*. 2013;55(10):1171–8.
 21. Untoro J, Timmer A, Schultink W. The challenges of iodine supplementation: a public health programme perspective. *Best Pract Res Clin Endocrinol Metab*. 2010;24(1):89–99.
 22. Kousar J, Kawoosa Z, Hamid S, Munshi IH, Hamid S, Rashid AF. To estimate the effect of relationship of salt iodine level and prevalence of goiter among women of reproductive age group (15–49 years). *J Community Health*. 2013;38(6):1022–8.
 23. Bendhal L, Gammelgaard B. Separation and identification of Se-methylseleno-galactosamine, a new metabolite in basal human urine by HPLC–ICP–MS and CE–nano-ESI–(MS)². *J Anal At Spectrom*. 2004;19:950–7.
 24. See LC, Kuo CF, Yu KH, Luo SF, Chou IJ, Ko YS, et al. Hyperthyroid and hypothyroid status was strongly associated with gout and weakly associated with hyperuricaemia. *PLoS One*. 2014;9(12):e114579. doi:10.1371/journal.pone.0114579.
 25. De-Regil LM, Peña-Rosas JP, Fernández-Gaxiola AC, Dowswell T. Effects and safety of periconceptual oral folate supplementation for preventing birth defects. *Cochrane Database Syst Rev*. 2015;(12):CD007950
 26. De-Regil LM, Suchdev PS, Vist GE, Walleser S, Peña-Rosas JP. Home fortification of foods with multiple micronutrient powders for health and nutrition in children under two years of age (Review). *Evidence-Based Child Health*. 2013;8(1):112–201.
 27. Serdaru M, Vlădescu L, Avram N. Monitoring of feeds selenium status in a southeast region of Romania. *J Agric Food Chem*. 2003;51(16):4727–31.
 28. Terry N, Zayed AM, Desouza MP, Tarun AS. Selenium in higher plants. *Annu Rev Plant Physiol Plant Mol Biol*. 2000;51:401–32.
 29. Bayfield RF, Romalis LF. pH control in the fluorometric assay for selenium with 2,3-diaminonaphthalene. *Anal Biochem*. 1985;144(2):569–76.
 30. Stecher RM, Hersh AH, Solomon WM. The heredity of gout and its relationship to familial hyperuricemia. *Ann Intern Med*. 1949;31(4):595–614.
 31. Goldner WS, Sandler DP, Yu F, Shostrom V, Hoppin JA, Kamel F, et al. Hypothyroidism and pesticide use among male private pesticide applicators in the agricultural health study. *J Occup Environ Med*. 2013;55(10):1171–8.
 32. Mándoki Z, Albert C, Pohn G, Salamon S, Csapó-Kiss Z, Csapó J. Separation and determination of selenoamino acids in foods and feeding stuffs by ion-exchange chromatography. In: 15th International Conference Krmiva; 2008; Opatija, Croatia. Zagreb: Croatian Society of Food Technologists, Biotechnologists and Nutritionists; 2008. p. 90.
 33. Mándoki Z, Pohn G, Lóki K, Albert C, Albert B, Csapó-Kiss Z, et al. Determination of selenoamino acids by ion-exchange column chromatography and by high performance liquid chromatography. In: 7th Balaton Symposium on High-Performance Separation Methods; 2007; Siófok, Hungary. p. 139.