

Selenium supplement for treatment of geriatric rhinitis

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With the aging of population, the incidence of geriatric problems is increasing. However, the diagnosis and treatment of geriatric problems are usually ignored. This study investigated the efficacy of supplemental selenium in patients with geriatric rhinitis (GR). The study was conducted at an academic secondary referral center in a prospective design. Patients were divided into two groups, and they were compared with healthy volunteers. The treatment group, including patients with GR, was given nasal saline wash four times daily and 100 µg of seleno-6 dietary supplements twice daily. The patient control group and the healthy volunteers were given only the nasal saline wash four times daily. Glutathione peroxidase, superoxide dismutase, and catalase levels were measured in all participants before and after treatment. In addition, the sino-nasal outcome test-20 and visual analog scale were applied before and after treatment. In the selenium supplement group, the visual analog scale, sino-nasal outcome test-20 scores, and enzyme levels were significantly improved compared with the untreated group. No adverse effects occurred in the selenium supplement group during the study. Supplemental selenium might be effective in the treatment of GR in terms of aging physiology and the oxidative system. However, large-scale randomized studies are needed to determine the optimal treatment.

Keywords:

antioxidants, geriatric rhinitis, selenium, sino-nasal outcome test-20

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Introduction

Aging is natural and inevitable. A population is considered to be aging when more than 7% of the total population is older than 65 years [1]. The desire to live a long life has prompted research on advanced age. Unfortunately, quality of life is not correlated with a prolonged life span. With the increasing geriatric population and elongation of life, the incidence of degenerative and chronic diseases is increasing.

Geriatric rhinitis (GR) is one of the problems that disrupt the quality of life in elderly population [2]. GR consists of nasal obstruction and dryness, thickened mucous, rhinorrhea, and olfactory dysfunction [3]. A generalized decrease in body water content along with the degeneration of mucous-secreting glands leads to reduced mucociliary activity and symptoms of nasal stuffiness. A decrease in nasal blood flow, atrophy and drying of the nasal mucous membrane, structural changes in the nose with age, and downward rotation of the nasal tip contribute to the GR pathology [4]. The treatment of GR is still unclear, and it is usually managed symptomatically.

Selenium is important for many cellular functions in the body, and it plays critical roles in human metabolism, DNA synthesis, tissue flexibility, and protection from oxidative damage and infection. Several selenoproteins,

such as glutathione peroxidases (GPx), play important roles in anti-oxidative defense mechanism [5]. As the selenium content of the soil varies in different parts of the world, the estimated selenium intake varies among populations from different geographical regions. In European and Middle Eastern countries, the dietary selenium intake was considered as suboptimal [6].

The present study aimed to investigate the effect of selenium supplementation in patients with GR. This was done through selenium supplementation of patients with GR for 3 months and comparing their clinical outcomes with the untreated control group and healthy controls. The serum GPx, catalase, and superoxide dismutase (SOD) levels were also measured before and after the study.

Patients and methods

This prospective study enrolled 25 patients older than 65 years with nasal stuffiness and dryness, thickened mucous, olfactory dysfunction, and a chronic cough, and 10 patients with no complaints as healthy control.

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Written informed consent was obtained from all patients. A complete ear, nose, and throat examination, including nasal endoscopy was performed by a specialist clinician. Skin prick test was performed for eliminating any possible allergic situation (Allergopharma, Merck, Turkey). Fifteen patients complaining of nasal obstruction, dryness, crusting within the nose, cough, excessive drainage, and olfactory loss with negative allergy testing were included in group 1, which applied nasal saline wash four times daily and received seleno-6, 100 µg dietary supplement, twice daily (Solgar, New Jersey, USA). Group 2 included 10 patients with similar complaints, and they applied only nasal saline wash four times daily. Group 3 included 10 healthy individuals with no symptoms or anatomical problems who also performed nasal saline washes four times daily. Participants performed these treatments for 3 months. Participants with allergic rhinitis, rhinitis medicamentosa, previous nasal surgery, and severe intranasal abnormalities were excluded. Other exclusion criteria were cigarette smoking, gastroesophageal reflux, and using medicines that can cause chronic cough, nasal congestion, and dryness, such as antihypertensive drugs, beta blockers, anxiolytics, and anti-vertiginous medication [7].

The serum GPx, catalase, and SOD levels were measured at the beginning and at the end of the study. After a 12-h fasting, 5 ml of venous blood samples was collected in EDTA tubes containing the polypeptide aprotinin (EDTA-Aprotinin Tubes; Greiner Bio-One GmbH, Germany) between 8:00 and 10:00 a.m. The samples were centrifuged at 2500g for 15 min within 1 h of collection and stored at -70°C until assayed. Enzyme levels were measured using a Cayman Chemical Assay Kit with BioTekELx-800 ELISA reader. All the measurements were repeated twice.

The sino-nasal outcome test (SNOT-20) was used to evaluate the quality of life, and a visual analog scale

(VAS) was used to rate the effect of the disease on the participants' general status initially and after 3-month treatment. The SNOT-20 consists of questions on rhinological, ear/facial, psychological, sleep, and unclassified symptoms such as coughing and waking up tired. Symptom scores were compared for the SNOT-20 subgroups [8].

The normal distribution of data was checked with the Shapiro-Wilk test; because the parameters did not show normal distribution, the nonparametric analyses were performed. Pretreatment and posttreatment levels with the groups were analyzed with the Kruskal-Wallis test and Mann-Whitney *U* test, with the Bonferroni correction performed post hoc. The data obtained before and after treatment were compared using the Wilcoxon test. The values of *P* less than 0.05 were accepted as statistically significant difference.

Local ethics committee approval was obtained.

Results

The mean age of the patients was 71.7±5 years. In the patient groups, the most frequent complaints were the need of blowing the nose, a thick nasal discharge, postnasal discharge, difficulty of falling asleep, and waking up at night. The mean duration of symptoms was 5.5±3 years (range, 2–10 years). The most prominent nasal examination findings were nasal dryness, crusting, turbinate atrophy, and loss of nasal tip support.

At the beginning of the study, both of the patient groups had significantly higher total SNOT-20 scores (*P*<0.05, Table 1). A subgroup analysis for SNOT-20 scoring revealed statistically significant differences for all the subgroups between patients and healthy group (*P*<0.05, Table 1). On the contrary, the selenium-treated and untreated patients significantly differed in

Table 1 Total and subgroup sino-nasal outcome test-20 scores of the participants before and after treatment

	Selenium-treated patients		Untreated patients		Healthy controls	
	Before	After	Before	After	Before	After
SNOT-20 total	47.00±10.43 ^{*,#}	33.00±3.92 ^a	35.70±4.08 [*]	33.70±6.18	25.80±4.46	23.90±4.72
Rhinological	15.53±3.68 ^{*,#}	10.60±2.16 ^a	8.00±1.63 [*]	8.00±1.56	6.40±1.50	6.20±1.39
Ear/facial symptoms	8.40±2.90 [*]	5.60±2.41 ^a	8.20±1.81 [*]	7.60±1.57	6.50±2.30	6.00±2.05
Psychological	14.93±4.33 ^{*,#}	10.13±2.80 ^a	8.60±1.57 [*]	7.10±2.37 ^a	6.40±2.01	5.30±2.63 ^a
Sleep symptoms	5.27±2.08 [*]	3.67±1.83 ^a	6.20±1.31 [*]	6.20±1.93	3.90±1.52	3.70±1.16
Unclassified symptoms	3.00±1.55 [*]	2.93±1.16 ^a	4.70±0.67 [*]	4.90±1.28	2.70±0.94	2.50±0.70
VAS score	8.6±1.1	4.6±1.2 ^a	8.2±1.4	6.4±0.9 ^a	–	–

SNOT-20, sino-nasal outcome test; VAS, visual analog scale, used to rate the effect of the disease on the participants' general status. ^{*}*P* value less than 0.05, significantly different from the healthy control group. [#]*P* value less than 0.05, significantly different from the untreated patient group. ^a*P* value less than 0.05, significantly different from the beginning of the study.

Table 2 Glutathione peroxidase, superoxide dismutase, and catalase enzyme levels of the participants before and after treatment

	Selenium-treated patients		Untreated patients		Healthy controls	
	Before	After	Before	After	Before	After
GPx ($\mu\text{g/ml}$)	112.47 \pm 39.40* [#]	156.87 \pm 67.13 ^a	79.9 \pm 16.89	83.3 \pm 17.60	78.1 \pm 25.19	81.9 \pm 24.92
SOD ($\mu\text{g/ml}$)	1.15 \pm 0.57	1.33 \pm 0.51 ^a	1.13 \pm 0.53	1.13 \pm 0.52	1.46 \pm 0.92	1.53 \pm 0.85
CAT ($\mu\text{g/ml}$)	6.22 \pm 3.17	8.52 \pm 5.17 ^a	5.49 \pm 2.76	5.60 \pm 2.65	7.78 \pm 4.27	7.92 \pm 4.08

CAT, catalase; GPX, glutathione peroxidase; SOD, superoxide dismutase. **P* value less than 0.05, significantly different from the healthy control group. #*P* value less than 0.05, significantly different from the untreated patient group. ^a*P* value less than 0.05, significantly different from the beginning of the study).

terms of the total SNOT-20 scores, rhinological symptoms, and psychological functioning (*P*? 0.05, Table 1).

After a 3-month treatment period, the total SNOT-20 scores of the selenium-treated patients (*P*<0.05), but not the untreated patients and the healthy group (*P*>0.05), significantly reduced compared with the beginning of the study (Table 1). Selenium treatment significantly reduced all the subgroup scores in SNOT-20 (*P*<0.05, Table 1). Psychological scores were reduced in untreated patients and healthy controls compared with initial scorings (*P*<0.05, Table 1).

There was no difference for VAS scores between treated and untreated patient groups at the beginning of the study (*P*>0.05, Table 1), and after the 3-month treatment, VAS scores were significantly decreased in both groups (*P*<0.05, Table 1).

The serum GPx level was significantly higher in the selenium treatment group compared with other two groups at the beginning of the study (*P*<0.05, Table 2). The initial catalase and SOD levels were not different among the groups (*P*>0.05, Table 2). After 3 months of follow-up, GPx, catalase, and SOD levels were significantly increased in selenium treatment group compared with initial levels (*P*<0.05, Table 2). There was no significant changes in the enzyme levels in untreated group and healthy controls (*P*>0.05, Table 2). During the study, any adverse effects related to selenium treatment were seen during the study.

Discussion

The present study indicated that selenium supplement could be useful for alleviating the symptoms of GR, a rhinological problem frequently impair the quality of life in elderly. Humidification, saline irrigation, nasal steroids, intranasal ipratropium, and hormone replacement therapies are commonly used in the management of GR. Unfortunately, all of these treatments have limited effects, and an important goal for the clinicians should be preventing the

occurrence of this pathology. Using dietary supplements in risky groups may be an option for preventing health problems seemed inevitable.

Selenium is essential for human metabolism and is usually present in seafood and organ meats [9]. Selenium is a component of vital enzymes, such as GPx, selenoprotein-P, and thioredoxin reductase, which play critical roles in the cell cycle and DNA repair [10]. It protects organism against free radicals by maintaining enzyme activity. Recent studies have shown that low selenium levels are associated with various pathologies in the elderly, such as poor muscle strength, anemia, depression, and increased mortality [11–13].

Oxidative stress plays a major role in aging physiology. With aging, the ability to inactivate oxygen radicals and to prevent lipid, nucleic acid, and protein oxidation decreases. This process negatively affects the normal cell cycle and DNA repair. These changes occur predominantly in the tissues with faster blood perfusion and higher metabolic rates [14]. Given the higher vascularization in the nose, the nasal cavity might be a target of senescence via the accumulation of antioxidants and oxidative stress. Degenerative processes decrease the number of goblet cells and cilia, reduce tip support, and lead to atrophy of the nasal turbinates, which lose their function and normal physiological structure [15]. In the present study, the GPx level was significantly higher in the patients compared with the healthy controls; thus, an endogenous reactivation by the pathology may already be present. This was not shown in SOD and catalase. After 3 months of selenium supplementation, the GPx, SOD, and catalase levels were significantly increased. On the clinical aspect, in the selenium supplementation group, there were significant improvements in all the subgroups of SNOT-20 and VAS score.

We used the SNOT-20 and VAS scores to evaluate subjective symptoms and the quality of life before and after treatment. The SNOT-20 is used to evaluate the general quality of life, as well as specific diseases such as

GR using specific questions, like rhinological symptoms (questions 1, 2, 4, 5, 6), ear/facial symptoms (questions 7–10), sleep function (questions 11–13), and psychological symptoms (questions 15–20) [8]. In the elderly, nasal gland atrophy and a decreased nasal blood supply results in nasal crusting, thick nasal discharge, and dryness [14]. Ultimately, this causes nasal irritation and increased oral respiration, which causes a sore throat and related sleep disorders. GR affects not only the nasal region but also the general well-being of the elderly. In the present study, although treatment with selenium and saline irrigation resulted in improvement in all the parameters, only the psychological scores were improved in untreated GR control group.

The antioxidant effects of selenium could be enzymatic and/or nonenzymatic. Enzymatically, GPx contains a selenium atom in each of its subunits in the form of *selenocysteine* and plays a role in the reduction of intracellular H_2O_2 to H_2O . Nonenzymatically, selenium protects the cell membrane from lipid peroxidation by interacting with vitamin E [16]. The increment in GPx activity with supplemental selenium could be related to the optimal selenium levels in human metabolism. Although, the activity of GPx decreases with a lack of selenium, no additional increment is seen with excess selenium [17]. Our study demonstrated a positive effect of selenium treatment, which ultimately increased the activity of antioxidant enzymes in patients with GR. Although only the pretreatment GPx levels were different from the control group, the posttreatment levels of all three enzymes were significantly increased. This result might support the adjuvant effect of selenium on both the GPx-dependent and independent antioxidant activity.

The routine use of selenium as a mineral supplement is controversial. Although low-dose selenium supplements are anti-carcinogenic and have regulatory effects in apoptosis and autophagy, excessive uptake selenium might induce carcinogenesis, cytotoxicity, and genotoxicity. Therefore, it is very important to know the normal selenium levels in a population or patients while considering the dose of supplemental selenium. The recommended selenium dose in healthy adults is 55 $\mu\text{g}/\text{day}$ in America, 30 $\mu\text{g}/\text{day}$ in most European countries, and 50–250 $\mu\text{g}/\text{day}$ in China [18]. One shortcoming of our study was that we did not determine the pretreatment blood selenium levels. Zeyrek *et al.* [19] found that the selenium concentration was lower than 40 $\mu\text{g}/\text{kg}$ in 88% of growing plants, which is far below the level a healthy human requires. Therefore, it is likely that residents of our country might be deficient in selenium, and empirical

selenium supplementation is not likely to cause toxic adverse effects. Further studies should measure the basal selenium levels and adjust the treatment dosage accordingly.

Conclusion

- (1) GR disrupts the comfort of elderly.
- (2) Selenium supplementation may alleviate the symptoms of GR.
- (3) Antioxidant activity of selenium may contribute toward its treatment effect.

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Conflicts of interest

There are no conflicts of interest.

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