



# Vitamin E and Hearing Loss

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## Introduction

Hearing loss is the most common sensory disorder among adults in the United States, and can arise from noise exposure, age, genetic causes and predispositions to hearing loss, ototoxic drug exposure, or any combination of the above.

Avoiding noise exposure, wearing hearing protection devices and avoiding ototoxic drugs can help prevent hearing loss. Monitoring hearing status can help highlight ways to manage hearing loss, and the possibility of consuming antioxidants to protect against hearing loss has become more common in the media.

## Question

Does consumption of the antioxidant vitamin E help prevent against any type of hearing loss? More specifically, is dietary consumption of vitamin E associated with better hearing thresholds (thus, potentially play a protective role against age or noise induced hearing loss)? Can vitamin E intake during periods of exposure to ototoxic drugs play a protective role for auditory functioning?

## Search Terms

Search Term	Variants
Vitamin E	γ-tocopherol; alpha-tocopherol
Prevention	Protective; preventative
Hearing Loss	Noise induced hearing loss; presbycusis; chemical induced hearing loss; ototoxic; sensorineural hearing loss

## Inclusion / Exclusion Criteria

The following inclusion criteria was used in selecting articles to review from the returned literature results:

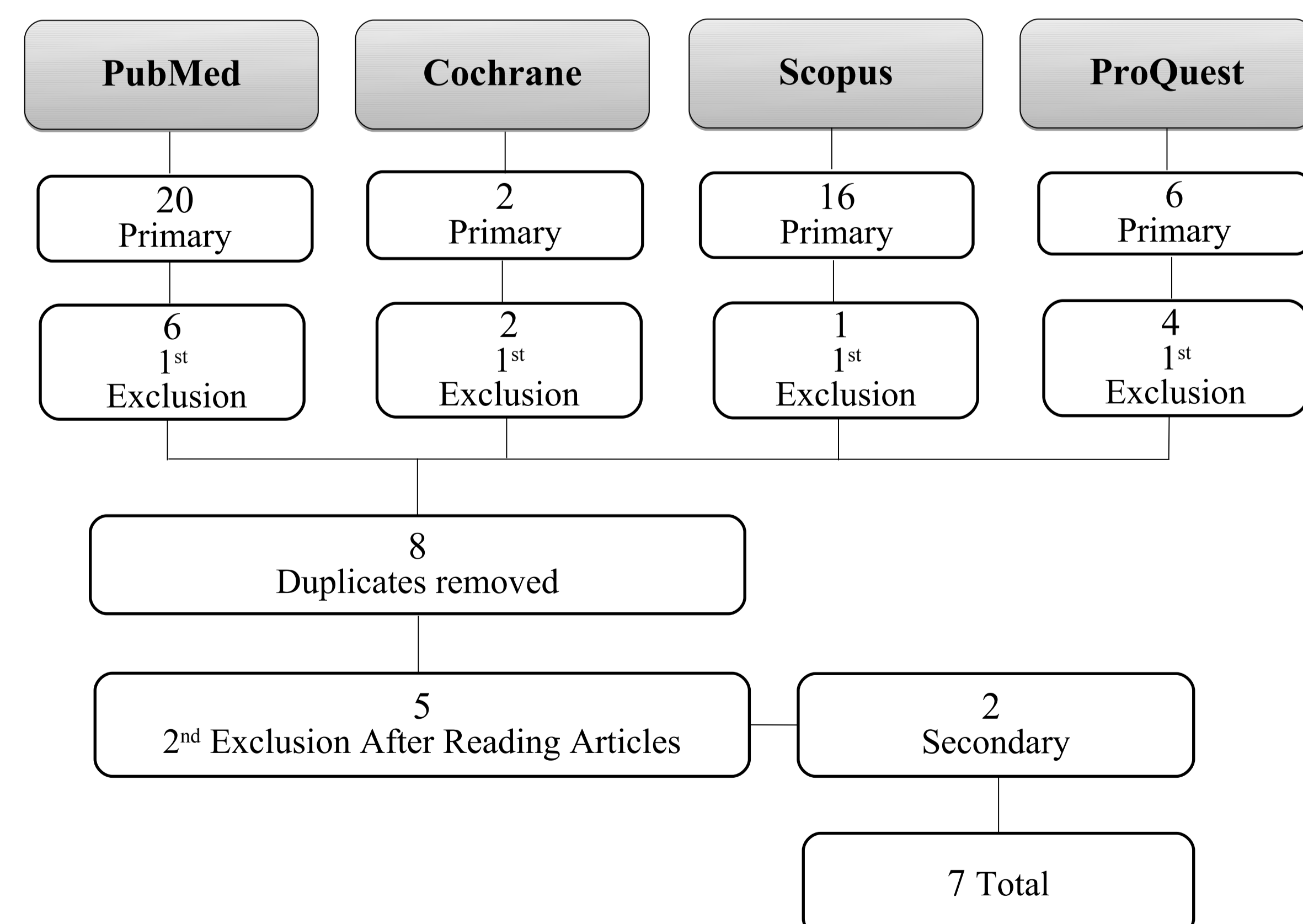
- Examines impact/association of vitamin E and hearing loss
- Subjects/participants are human
- Can be easily accessed through Western University libraries

The following exclusion criteria was used in selecting articles to review from the literature search results:

- Subject/participants were not human
- Cannot easily be accessed through Western University libraries
- Duplicates from different database results
- Not available in English

## Literature Search

A systematic review of the literature was conducted. Search terms were run through databases, including PubMed, Cochrane Review, Scopus, and ProQuest for the primary literature search. An additional, secondary search was completed using references from several articles found in the initial search; two additional references were found. The primary and secondary searches yielded 48 articles. The number of results from each search is outlined in the flowchart below.



The 7 remaining articles were appraised and key data was extracted using the data extraction tool. The data extraction tool is illustrated in the **Results** section of this poster.

## Results

The literature search resulted in 7 articles for data extraction. The articles were appraised for their quality using the Crow Critical Appraisal Tool (CCAT) Version 1.4 and the CCAT form. The data extraction tool was used to highlight key information and relevant findings from each article. Categories on the data extraction tool included: authors, year of study, year of publication, research question/objective, setting, research methods, sample size, participant demographics, description of intervention, statistical analyses, results, findings/conclusions, and CCAT score. Select data has been extracted from the 7 retrieved articles and is shown in the abbreviated data extraction table below.

#	Research Question/ Objective	Participants	Description of Study	Results (in relation to Vitamin E consumption)	Findings/Conclusions (in relation to Vitamin E consumption)	CCAT Quality Rating Score
1	To determine how the longitudinal intake of various vitamins influences hearing loss in men	3559 (Men age 40-75 at baseline)	Examine the intake of vitamins (in food and supplements) of men every two years from 1986 to 2004 and examine the amount of total vitamin intake to self-reported diagnosed hearing loss of participants of the Health Professionals Follow-up Study (HPFS).	Vitamin E, C, and B12 intake was not associated with risk of hearing loss. For men over 60 years old, those in the upper quartile of folic acid intake had a 21% lower risk of developing hearing loss	Vitamin E has not been shown to be associated with reduced incidence of hearing loss	68% (or 27/40)
2	To determine if dietary and supplement intake of vitamins effects incidence and prevalence of hearing loss	2 956 (Age 50+ at baseline)	Survey of vitamin intake (food and supplements), as well as measurement of pure-tones at 500 Hz, 1 kHz, 2 kHz, and 4 kHz at 5 year mark. Cross-sectional study of the Blue Mountains Hearing Study (BMHS) participants	In terms of prevalence, each standard deviation increase in vitamin E consumption was associated with a 14% reduced likelihood of prevalent hearing loss. However, no vitamin intake was associated with decreased incidence of hearing loss over a 5-year period.	Vitamin E consumption was associated with better hearing sensitivity	58% (or 23/40)
3	Is the intake of specific foods and nutrients examined at baseline associated with level of hearing loss measured 13 years later.	1824 (Age 45-64 at baseline)	Participants' nutrient consumption was measured at baseline (assume that this is representative of their general nutrient consumption). Hearing loss (averaged between 500 Hz, 1 kHz, 2 kHz, and 4 kHz) was measured 13 years later.	Logistical regression indicated that higher levels of B12 consumption was associated with better hearing levels in women, but vitamin E was not associated with better hearing level in men or women.	Vitamin E consumption was not associated with better hearing sensitivity	63% (or 25/40)
4	Can vitamin E prevent gentamicin-induced ototoxicity in human patients?	52 (Age 18-65)	Randomized, double-blind study in which patients with acute pulmonary infections receiving 249 mg of gentamicin daily were also given either a placebo or 2800 mg of Vitamin E for one week. Hearing was assessed before exposure and 6-8 weeks after exposure.	At follow up, 3 criterion were used to identify hearing loss, and by none of these criterion were there significant differences between the Vitamin E and placebo groups	Vitamin E was not found to prevent gentamicin-induced hearing loss.	70% (or 28/40)
5	Are there associations between diet (nutrients) and auditory function?	2111 (Mean age 67.2)	Auditory function was assessed (pure tone audiometry: Low PT average from 250 Hz-2kHz, high PT average from 3kHz-8kHz) and TEOAEs. Before testing patients completed a mailed food frequency questionnaire. Cross-sectional study.	Several nutrients were found to be associated with hearing level. Vitamin E was associated with better high and low pure tone averages, but not with TEOAE levels	Vitamin E consumption was associated with better auditory function (both high and low pure tone averages).	73% (or 29/40)
6	Can a combination of Vitamin E, C, and selenium help reduce hearing loss among chemotherapy patients treated with cisplatin?	48 (Age 16-69)	Randomized, double-blind placebo-controlled study in which 25 patients received a beverage containing 1000 mg of Vitamin C, 400 mg of vitamin E and 100 µg of selenium twice per day one week before chemotherapy up to 3 weeks after the completion of chemotherapy, 23 control patients received a placebo. Plasma level concentrations of the antioxidants were also monitored in all patients. Hearing levels were tested prior to each round of treatment.	No significant difference between the experimental and control group was found in relation to hearing loss. However, those patients with higher plasma levels of Vitamin C + Vitamin E + Selenium during the start of the study and the first round of chemotherapy had less loss of hearing sensitivity and renal function.	The supplementation of a mixture of vitamin c, e, and selenium did not significantly effect hearing loss in chemotherapy patients being treated with cisplatin. However, higher levels of these antioxidants in the plasma were associated with less hearing loss, the authors recommend more research with higher concentrations of antioxidants.	75% (or 30/40)
7	Are antioxidants (β-carotene and vitamins C and E) and magnesium associated with reduced risk/prevalence of hearing loss?	2592 (Age 20-69)	Cross-sectional data from the NHANES (National Center of Health Statistics) was analyzed. Intake of β-carotene and vitamins C and E and magnesium was analyzed along with audiometric data of participants PTA averages from 500 Hz-4 kHz (speech frequencies) and high frequencies (3,4,6 kHz PTA)	Higher levels of vitamin E intake were associated with better speech frequency PTA averages, but not better high frequency PTA average. (Results show no interaction for vitamin E and magnesium intake)	Vitamin E intake was associated with better PTA averages (0.5, 1,2,4 kHz)	68% (or 27/40)

## Conclusions

Data collected from the 7 reviewed articles suggests, overall, that vitamin E and hearing level association is weak at best. Of the 5 Large-scale longitudinal and cross-sectional studies, 2 studies did not indicate any association between vitamin E intake (through diet and supplements) to be associated with hearing level sensitivity. Conversely, 3 of these large-scale studies did find weak association between vitamin E intake and better hearing level sensitivity. No firm conclusions can be made as to whether the long term consumption of vitamin E is protective of hearing sensitivity. This review also includes 2 studies which examined vitamin E (either alone or with additional nutrients) intake during ototoxic drug exposure to determine if vitamin E had a protective effect for hearing. In relation to gentamicin exposure, vitamin E was not protective for hearing sensitivity. When combined with other nutrients, it was also ineffective at preventing hearing loss due to cisplatin exposure. Overall there is not definitive evidence that hearing sensitivity is protected or that hearing loss is prevented by vitamin E intake.

A limitation of this systematic review is the exclusion or inclusion of journal titles in databases searched. It is not always easy to tell which journals are included in a database selection. By only using databases to search for articles, and by only using 4 databases for the search, other journal articles may have been missed. The secondary search was performed using the reference lists of the articles and 2 additional, relevant articles were found which had not appeared in the initial database search. This limitation could be improved by inquiring which journal titles (and years of publication) are included in the database, by searching through additional databases, and by doing additional searches in the journals in which the previously found articles appeared.

Future research for the topic of this systematic review could include looking at animal studies. These studies have greater control and it would be more helpful in determining under which conditions Vitamin E was protective of hearing, and then reviewing how well those conditions were met in the human studies. Additionally, future research should examine higher doses of vitamin E during ototoxic drug exposure, and then follow those patients for hearing sensitivity for longer periods.

## References

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