Vitamin B12 & Hearing Loss

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Introduction

Vitamin B12 (cobalamin or cyancobalamin) deficiency may be a preventable risk factor for hearing loss. B12 deficiency may cause several neurologic abnormalities including peripheral neuropathy, destruction of the microvasculature of the stria vascularis, demyelination, axonal degeneration and eventual neuronal death. Vitamin B12 deficiencies may also adversely affect blood flow to the inner ear as a result of elevated total serum homocysteine (tHcy), and in correspondence to elevated serum methylmalonic acid (MMA), which are both widely used markers of B12 status.

Question

Does Vitamin B12 deficiency affect hearing status?

Search Terms

vitamin b12 deficiency • vitamin b12 deficiencies • hearing loss • noise-induced hearing loss (NIHL) • age-related hearing loss (ARHL) • sensorineural hearing loss (SNHL) • presbycusis

Inclusion / Exclusion Criteria

The following criteria was used to select articles for review from the literature search results:

Inclusion:

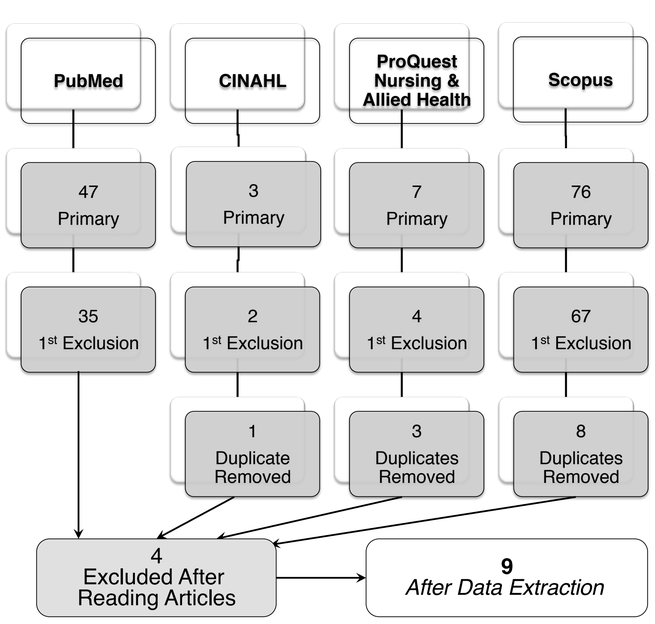
- Subjects are human and have permanent SNHL
- Hearing status was assessed using audiometry or otoacoustic emissions (OAEs)
- Research examines measured blood serum concentration levels for B12, MMA and/or tHcy
- Can be accessed through Western U. Libraries

Exclusion:

- Participants have a temporary threshold shift
- Participants suffer from another disease/condition
- Duplicates from various database search results
- Not available in English

Literature Search

A systematic review of the literature was conducted. Search terms were run through several databases including PubMed, CINAHL, ProQuest Nursing & Allied Health and Scopus for the primary literature search. The search yielded 133 results. The number of results from each search are outlined in the flow chart below.



Results

From the literature search, 9 of the retrieved articles were appraised for quality using the Crowe Critical Appraisal Tool (CCAT) Version 1.4. The abbreviated data extraction tool is illustrated below, showing the authors & year of the study, research objectives, sample size, methods, results, conclusions and CCAT Quality Score in %. The studies are presented in descending order from highest to lowest CCAT quality scores.

Authors & Year	Research Objective	Sample Size	Methods	Results	Conclusions	CCAT Score
Péneau et al., 2011	To determine the association between intake of specific foods/nutrients, including vitamin B12, and hearing loss in adults.	1823	A population-based approach examined a long-term 13-year association between nutrient intake and hearing loss in adults. The study was randomized, double-blind and placebo-controlled, and examined sex-specific associations.	Results indicated a significant association between vitamin B12 levels and hearing loss in women, while no association was found in men.	Reduced intake of vitamin B12 is associated auditory dysfunction in women, but not in men, suggesting sex differences.	90%
Gopinath et al., 2010	To determine the cross-sectional and longitudinal relationship between serum concentrations of vitamin B12, and tHcy, and risk of ARHL.	2956	Blood samples were drawn in participants 50 years of age and older to determine serum concentrations of vitamin B12 and tHcy. ARHL was measured as pure tone average at 0.5, 1.0, 2.0 and 4.0 kHz > 25 dB HL.	Serum vitamin B12 concentration was not significantly associated with ARHL. However, participants with elevated tHcy had a 64% increased likelihood of prevalent hearing loss (>25 dB).	There is a significant correlation between ARHL and elevated tHcy levels, but no direct relationship with vitamin B12.	85%
Park et al., 2007	To examine the relationship between ARHL and poor vitamin B12 status in older adults using various indices of B12 status and following a B12 supplementation.	93	A blinded audiologist assessed participants to determine hearing status, with hearing loss defined as a pure-tone average >25 dB HL. B12 status markers recorded included serum concentration levels of vitamin B12, MMA and tHcy.	Participants with impaired hearing had significantly higher serum MMA concentrations and prevalence of vitamin B12 deficiency. No differences were found in serum tHcy levels between the groups.	Higher serum MMA concentration and prevalence of vitamin B12 deficiency are associated with hearing loss in older adults.	75%
Gok et al., 2004	To determine the levels of vitamin B12 and tHcy in subjects with NIHL, and evaluate possible correlations.	60	28 male patients with NIHL (mean age 37±5 years) were compared with 32 healthy male controls (mean age 36±4 years) for levels of vitamin B12 and tHcy, obtained by blood samples.	Vitamin B12 levels of patients with NIHL were much lower compared to controls, and tHcy levels were much higher in patients with NIHL compared to controls.	There appears to be an association between both vitamin B12 deficiency, increased tHcy levels and the prevalence of NIHL.	70%
Berner et al., 2000	To examine a possible association between ARHL and vitamin B12 status in elderly adults.	91	Subjects of age ranging 67-88 years with pure ARHL underwent pure-tone, speech and impedance audiometry, and blood samples were drawn to determine B12 and tHcy levels.	No significant correlation between hearing status and vitamin B12 was found, and no differences as a function of gender. Only a weak correlation between between ARHL and tHcy levels was found.	There appears to be no strong association between hearing status and vitamin B12 levels, or tHcy levels, in elderly subjects.	68%
Lasisi et al., 2010	To determine the correlation between hearing threshold and serum levels of vitamin B12 (cyanocobalamin) amongst otherwise healthy elderly subjects with ARHL.	126	Pure-tone average for speech and high frequencies, and serum cobalamin were determined in elderly men and women >60 years of age with no other know medical conditions, using a cross-sectional study design.	Vitamin B12 was significantly associated with increased hearing thresholds in the high frequencies. But after adjusting for age, vitamin B12 was not significantly associated with hearing loss.	The correlation between vitamin B12 and ARHL does not appear to be significant after adjusting for age.	63%
Houston et al., 2013	To determine whether ARHL may be associated with poor vitamin B12 status in women.	55	Healthy women, aged 60-71 years, underwent audiometric assessment and were categorized into normal hearing and impaired hearing (pure-tone average >20 dB HL) groups. Blood samples were collected to determine serum B12 levels.	Women with impaired hearing had 38% lower serum B12 levels than those with normal hearing. Pure-tone averages were inversely correlated with serum vitamin B12 levels.	Poor vitamin B12 status appears to be associated with ARHL in women.	60%
Shemesh et al., 1993	To examine and compare the incidence of vitamin B12 deficiency in army personnel with normal hearing, NIHL only and NIHL with chronic tinnitus.	113	Army personnel, with a mean age of 37 years, were compared: 57 had tinnitus and NIHL, 29 had NIHL only, and 27 had normal hearing. Vitamin B12 serum levels were measured and audiometry was performed.	Vitamin B12 deficiency was observed (< 250 pg/ml) in 47% of patients with NIHL and tinnitus, 27% of patients with NIHL alone, and 19% of patients with normal hearing.	There appears to be a relationship between vitamin B12 deficiency and NIHL, especially with tinnitus.	60%
Karli et al., 2013	To investigate the possible association between cochlear function and vitamin B12 deficiency in patients with no symptoms of hearing loss.	53	Comparative analysis evaluated both transiently evoked OAEs (TEOAEs) and spontaneous OAEs (SOAEs) levels in a vitamin B12 deficient group (121-157 pg/mL), compared to healthy controls (210-435 pg/mL).	Results for TEOAEs at 1000Hz, SOAEs at 1500Hz and SOAEs at 4000Hz were lower in the vitamin B12 deficient group, compared to the control group.	There is a significant association between vitamin B12 deficiency and auditory dysfunction at the cochlear level.	55%

Conclusions

Data extraction from the 9 reviewed articles suggests that there is a relationship between vitamin B12 deficiency and hearing loss. Of the articles retrieved, 6 found a significant correlation between hearing loss and serum level of B12, whereas 3 articles did not. The CCAT quality scores for highest quality article supporting (Péneau, 2011) and refuting (Gopinath, 2010) the question of this review demonstrate that there is quality evidence for both sides. Additionally, of the studies examining other markers of B12 deficiency (elevated MMA and tHcy serum levels), 3 found significant correlations with hearing loss and 2 did not. Although there are some mixed findings, overall it can be concluded that vitamin B12 deficiency appears to be related to auditory dysfunction in many individuals.

A major limitation of this systematic review was the use of databases to search articles, as some journals may have been missed. Another limitation within some of the research was survival bias when examining older populations. Other possible confounding factors include folate deficiency, as it also elevates tHcy level, similar to B12 deficiency, ototoxic medication intake, noise exposure, other medical conditions, and genetic factors.

Future research for this topic could include large prospective and well-designed randomized control trials to determine if there are beneficial treatments for vitamin b12 deficiencies. Research could be strengthened by including more participants, audiometric assessments at baseline, and longer follow-up periods. Investigation into other lifestyle and dietary habits that may affect hearing function, as well as differences by sex would also be useful.

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