

Critical Review:
Can the use of folate or Vitamin B₁₂ affect the process of age-related hearing loss?

Ann-Louise Winter
M.Cl.Sc (AUD) Candidate

The University of Western Ontario: School of Communication Sciences and Disorders

This review examined the published evidence for the existence of a relationship between folate and/or vitamin B₁₂ status and age-related hearing loss, otherwise known as presbycusis. Based on vascular research, it was hypothesized that a decline in folate or vitamin B₁₂ levels could detrimentally affect the highly-vascularized cochlea, especially the stria vascularis, thus resulting in increased hearing threshold levels. Some of the studies examined herein used a correlational design and non-parametric statistical analysis and others used randomized controlled clinical trials with t-testing or ANCOVA—all with human subjects. The results were mixed, with some supporting a relationship and others not.

Introduction

Old age brings with it many infirmities, one of which is presbycusis. Presbycusis is a sensorineural hearing loss caused by the aging process alone (that is to say, not middle ear dysfunction or disease, or a medical or genetic condition). Based on work by Gates et al. (1999) and Willot (1996), Berner et al. (2000) concluded that presbycusis has both genetic components and environmental components such as noise, oto-toxic drugs and infections (p. 633), while Darrat et al (2007) added random alterations in the structure and function of macromolecules, cells and organ systems (p. 358). Darrat et al (2007) continued that, according to their own research, oxidative stress, resulting in increased mitochondrial DNA mutations and a concomitant reduction in mitochondrial function [is one of the factors in the aging process]. These changes ultimately lead to cellular and subcellular dysfunction, which [probably results in a] significant decrease in auditory sensitivity. The generation of [reactive oxygen species] is partly responsible for the reduction in the mitochondrial membrane potential and the loss of cochlear hair cells, with an attendant increase in the auditory threshold. (p. 359)

Overall bodily health can also affect the auditory system. In particular, poor vascular health can affect the cochlea since it is heavily vascularized, thereby affecting hearing (Houston et al, 1999, Durga et al., 2006). Ubbink et al. (1993) and Welch and Loscalzo (1998) pointed to links between low folate or B vitamin levels and elevated homocysteine as being risk factors for vascular disease. Researchers have hypothesized that elevated homocysteine levels, which have been associated with...changes in microvessel flow mechanics...may be linked to the changes in microvessel permeability, cochlear blood flow and stria

Marital status was not noted except in Durga et al (2007) who noted that some of their subjects had another member of the family (living with them) who was also involved in their study. Marital status, education and socioeconomic status is known to have an effect on nutritional levels. Future research studies should attempt to measure or control these factors in order to ascertain the effect of long-term nutritional intake and any potential effect on the study results. Reidiger and Moghadasian (2008) found links between higher socioeconomic status and education level, gender (being female), marital status (married vs. common-law/never married) and nutrition, specifically higher fruit and vegetable intake.

For comparison purposes, all the studies that included normal hearing subjects except Houston et al used a cut-off PTA of 25 dB HL to designate normal hearing. People with varying hearing losses were included in the reviewed studies; for example, subjects with a mean mild to severe sloping loss (Berner et al, 2000), mean normal to mild loss (Durga et al, 2006 & 2007) and a mean moderately-severe loss (impaired group) (Park et al, 2006) were tested. The difference in cut-off makes it challenging to compare Houston et al's grouped results to the others, especially since Houston et al's mean of 26.8 dB HL (SD 5.5, range 20-35) for their impaired group was just above the other studies' criterion for normality and their impaired hearing group was quite small to start with (n = 11).

In two of the studies, no blinding of subjects or research staff was noted. This could affect the subjects' food intake or reporting if they knew what the authors were measuring and could influence the form and tone of interviewers' questions. The studies relied on self-report rather than food diaries, which may have resulted in inaccurate estimates of intake.

However, in

reductase 677C T mutation' *Neurobiology of Aging*
2006; 27:482-89

Durga J, Verhoef P, Anteunis LJC, Schouten E & Kok
FJ, Effects of folic acid supplementation on hearing in
older adults' *Annals of Internal Medicine* 2007; 146:1-9

Houston DK, Johnson MA, Nozza RJ, Gunter EW, Shea
KJ, Cutler M & Edmonds JT, Age-related hearing loss,
vitamin B-