Nutritional effect of micronutrients (vitamins, minerals, antioxidants, omega-3 fatty acids) on age-related macular degeneration
Preface

According to the World Health Organization (WHO), age-related macular degeneration (AMD) is the most frequent cause of blindness in the Western world and a wide-spread disease in the population. In Europe alone about 2.5 million people older than 65 suffer from the disease which is associated with a drastic deterioration of the quality of life.

Factors influencing AMD include the supply of micronutrients, such as antioxidant vitamins, trace elements and omega-3 fatty acids. Oxidative stress plays an important role in the development of AMD. Besides various retinal antioxidants, it is mainly the macular pigment consisting of lutein and zeaxanthin that protects the eye against oxidative stress.

The level of antioxidants in the macula can be increased by supplementation. Omega-3 fatty acids, vitamin D and the B vitamins are also essential to patients suffering from age-related macular degeneration.

Often the need for these micronutrients cannot be covered by the standard diet alone. This is why a supplementing micronutrient combination that provides the body with the nutrients essential to the eye is so important.
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Factors influencing AMD include the supply of micronutrients, such as antioxidant vitamins, trace elements, and omega-3 fatty acids. Oxidative stress plays an important role in the development of AMD. Besides various retinal antioxidants, it is mainly the macular pigment consisting of lutein and zeaxanthin that protects the eye against oxidative stress.

The level of antioxidants in the macula can be increased by supplementation. Omega-3 fatty acids, vitamins D and the B vitamins are also essential to patients suffering from age-related macular degeneration. Often the need for these micronutrients cannot be covered by the standard diet alone. This is why a supplementing micronutrient combination that provides the body with the nutrients essential to the eye is so important.
Quality of life of people with impaired vision in old-age: The example of age-related macular degeneration

Lebensqualität bei Seheinschränkung im Alter: das Beispiel altersabhängiger Makuladegeneration


Study design, patients and methods
Age-related macular degeneration (AMD) has a great impact on the psychosocial quality of life. In their review article, the authors have compiled the results of current research on the quality of life of people with AMD and evaluated them in view of their practical implications. The evaluation is based on 15 studies, most of them randomized controlled studies including groups of AMD patients of advanced age, i.e. above 78 years on average. The intervention periods varied between 3 and 8 weeks with 1 to 2 visits per week.

Results
The studies rather consistently showed beneficial effects based on the quality of life indicators, such as depression, emotional stress and normal everyday functions. The group situation seemed to be helpful in the sense of “I’m not alone with my AMD problems”, in the sense of model learning and the experience of being appreciated and cared about. In two studies these beneficial effects disappeared at follow-ups (an individualized intervention at home and a short-time intervention).

Conclusion
The authors believe that, besides the well-founded knowledge of the serious psychosocial problems connected with AMD, there is substantial evidence today that group interventions are a particularly helpful instrument for restoring the impaired quality of life and stabilizing it. In the view of the authors, successful interventions are possible even for patients well advanced in age. There is no real problem of recognition, but rather a problem of implementation.
Age-related macular degeneration and depression – current findings
Age-related macular degeneration and depression: a review of recent research

Study design, patients and methods
The aim of this survey article was to summarize current findings on the relationship between depression and age-related macular degeneration (AMD). For this purpose, the authors reviewed articles that (1) dealt with the functional consequences of AMD, (2) evaluated the extent and interaction of the psychological complaints of AMD patients, and (3) described interventions appropriate for AMD patients.

Results
The literature showed that the prevalence of depression was rather high in AMD patients (about 30%) and that depression was the single most important factor of disability of AMD patients, even if the severity of the loss of vision was taken into account. The authors discussed interventions that may alleviate the emotional problems associated with a loss of vision.

Conclusion
Some studies showed clearly that AMD is a risk factor for depression and that serious consequences for the quality of life of AMD patients may result from it.
Bilateral visual impairment and health-related quality of life – the Blue Mountains Eye study

Impact of bilateral visual impairment on health-related quality of life: the Blue Mountains Eye Study

Study design, patients and methods
In a cross-sectional study, the second Blue Mountains Eye Study (BMES), the impact of impaired vision on the health-related quality of life (HRQOL) of an older population group was evaluated and compared with the effects of other severe diseases. 3,509 subjects at an average age of 66.7 years (57% of them women) were included in the study. They were asked to fill in a questionnaire providing information about their health status (self-administered 36-item short-form health survey, SF-36), to participate in a detailed interview and to have their eyes examined. Visual impairment was defined as visual acuity below 20/40 (the better eye).

Results
Complete data were available from 3,154 (89.9%) subjects. In 172 (5.5%) of them visual impairment was diagnosed resulting from an error of refraction (correctable visual impairment), and in 66 (2.1%) it resulted from an eye disease (non-correctable visual impairment; 49 mild, 9 moderate, 8 severe). After adjustment for demographic and medical confounders, a trend towards lower SF-36 scores was observed in the subjects with non-correctable visual impairment as compared to the subjects with correctable impairment (PCS: pTrend = 0.01 and MCS: pTrend = 0.02). An increasingly severe non-correctable visual impairment was associated with significantly worse SF-36 scores in all (except in 2) scales. The impact of non-correctable visual impairment was comparable with that of diseases such as stroke and had a greater effect on the mental than the physical components (on average MCS = 46.2, PCS = 41).

Conclusion
Non-correctable visual impairment was associated with a reduced functional status and lower well-being to an extent comparable with that of other severe diseases.

SF-36: the questionnaire includes physical and mental components of the health-related quality of life – the subjective health (independent of the health status); the higher the SF-36 scores the greater the subjective health.
PCS = physical component score; score for the physical components
MCS = mental component score; score for the mental components
Study design, patients and methods
On the basis of available scientific studies, Deutsche Gesellschaft für Ernährung (DGE) analyzed and evaluated the vitamin supply of the German population and published its comments.

Results
An unfavourable food selection and insufficient vitamin supply was observed in every age group. Important risk factors for an insufficient supply of vitamins – mostly of several vitamins – could be identified, including
- low food intake, voluntarily or involuntarily, with a negative energy balance (e.g. in case of an energy-reduced diet or poor appetite at old age)
- extremely one-sided eating habits
- chronically high intake of coffee, tea, tobacco, alcohol etc.
- disorders of digestion, nutrient resorption and utilization
- big loss of nutrients in the storage and preparation of food
- veganism or other extreme alternative dietary habits
- medication

A lower food and nutrient intake is observed in chronically ill older people and quite generally with rising age. At an energy uptake of less than 1500 kcal/day it will be difficult to adequately and securely cover the need for essential nutrients by just eating the usual German mixed diet, according to DGE. Moreover, a sufficient supply of vitamin D to older people is particularly important as with increasing age the skin loses some of its ability to synthesize vitamin D after UV exposure. Even with a vitamin B₁₂ supply covering the need, the risk of vitamin B₁₂ deficiency increases strongly with increasing age, as about one third of the people above the age of 70 no longer produce enough gastric juice so that food digestion and consequently the release of vitamin B₁₂ are affected.

Conclusion
According to DGE, there are special risk groups in several age brackets with relatively unfavourable food selection and/or vitamin intake.
Micronutrients and their preventive potential

Mikronährstoffe – das präventive Potenzial ausreizen

Study design, patients and methods
In this article, the author deals with the question whether a well-balanced diet will actually ensure an adequate supply of micronutrients.

Results
According to the author, the Nutrition Survey published by the Robert Koch Institute (RKI) in 1998 indicated an insufficient supply of some vitamins. The rate of undersupply of vitamin E was between 50 and 60%, for vitamin D it was between 80 and 90%, for calcium about 35% (men) and about 42% (women), for iron about 47% (women), and for folic acid it was up to 90% (especially women wanting to have children). The marginal deficiencies of micronutrients seem to go beyond the official figures and to apply also to iodine, carotenoids, vitamin B₁₂, magnesium, fluoride, zinc and selenium. The risk groups with marginally insufficient supply include, e.g., adolescents, young women, older people, smokers, athletes, vegetarians.

The reasons for latent nutrient deficiencies in large parts of the population discussed by the author are:
• increasing consumption of highly processed food rather than food left in its natural state
• “empty” calories
• irradiation
• foreign substances in the food (e.g. pesticides, nitrites etc.)
• leached out and washed out soil
• losses during storage and transport
• bad eating habits
• exorbitant oxidative stress due to smoking
• excessive consumption of alcohol

Conclusion
A large part of these micronutrients has antioxidant functions in the organism and counteracts premature aging and civilization diseases. From the author’s point of view, specific supplementation of vitamins C and E (also in combination), B vitamins, carotenoids, omega-3 fatty acids, iron, zinc and selenium will be useful for a number of risk groups.
Micronutrient levels and deteriorating physical function in the elderly

Serum micronutrient concentrations and decline in physical function among older persons

Study design, patients and methods
In a long-term study the authors investigated whether low serum micronutrient concentrations are associated with subsequent loss of physical function in older men and women. For this purpose, 698 subjects at least 65 years old living in community were selected from a population register in Tuscany, Italy. Baseline examinations took place from 1998 until 2000, the 3-year follow-up from 2001 till 2003. Decline in physical function was defined as a loss of at least 1 point in the Short Physical Performance Battery during the 3-year follow-up.

Results
The average decline in the Short Physical Performance Battery score was 1.1 points. In the general linear model the vitamin E level at baseline (analysed as continuous measuring variable) was significantly correlated with the Short Physical Performance Battery at both follow-up and baseline ($b = 0.023; \ p = 0.01$). In the CART analysis an age above 81 (in 84% of the subjects) and vitamin E (in 60% of the subjects between 70 and 80 years) were identified as the strongest determinants of the loss of physical function.

Conclusion
These results furnish the empirical proof that low serum vitamin E levels are associated with a subsequent loss of physical function of elderly persons living in community. Clinical trials are needed to decide whether an optimal vitamin E concentration may reduce functional decline and beginning impairment of elderly persons.

CART: classification and regression tree
Role of oxidative damage in AMD

Oxidative damage in age-related macular degeneration

Study design, patients and methods
In this study, the authors Shen et al. investigated the hypothesis whether oxidative damage plays a role in age-related macular degeneration. For this purpose they examined post mortem the eyes of AMD patients and patients of comparable age without AMD for the presence of biomarkers for oxidative damage.

Results
In 4 eyes without any pathological AMD signs the relevant areas did not show any immuno-fluorescence staining of markers for oxidative damage, whereas evidence of extended oxidative damage of the retina, both posteriorly and anteriorly, was demonstrated by 8 to 12 eyes with advanced geographic atrophy.

Conclusion
These data suggest that extended oxidative damage occurs in the retina of some AMD patients and that such damage is more likely to be found in patients with advanced geographic atrophy. This leads to the assumption that there is a subpopulation of patients with geographic atrophy that may have an essential deficit in the antioxidative defence system so that, as a result, most of their retinal cells are exposed to the risk of oxidative damage.
Pathomechanisms of RPE aging and prophylactic AMD therapy options

Study design, patients and methods
In this article the authors present an overview of the scientific findings related to the pathomechanisms of RPE (retinal pigment epithelium) aging. An intact RPE is a basic condition for the function of the neurosensorial retina. In the authors’ view, a better understanding of these processes will contribute to developing new prophylactic approaches urgently needed in an aging society.

Results
According to the authors, scientific results clearly demonstrate that an increased oxidative stress is building up in the aging RPE which in the healthy RPE is neutralized by various oxidative protection mechanisms, such as antioxidant enzymes, melanin and antioxidants, whereby the antioxidant enzymes and melanin decrease with advancing age.

Conclusion
The authors conclude that antioxidant supplementation appears to offer a useful approach to reducing AMD prevalence. Studies such as the ARED-2 study will, as the authors believe, show in the future whether such approaches can be verified in a large patient cohort. They advise ophthalmologists to be prepared for a rising need and wish of an aging population to take preventive measures against age-related changes, such as AMD.
Micronutrient supplementation to strengthen the antioxidant defence of healthy subjects

Effects of multinutrient supplementation on antioxidant defense systems in healthy human beings

Study design, patients and methods
In this double-blind, placebo-controlled study the antioxidant defence system of 34 healthy subjects (21 men, 13 women) of an average age of 24.6 years was measured before and after micronutrient supplementation. Two groups of 17 subjects each were given either a placebo or the micronutrient supplement for a period of 16 weeks.

Results
After 5 weeks of supplementation, an increase in whole-blood plasma levels of vitamin C, vitamin E and beta-carotene, vitamin E and erythrocytes as well as selenium was observed. After 16 weeks of supplementation, the levels of reduced glutathion (GSH) and the enzyme activities of catalase (CAT) and glutathion peroxidase (GPX) had significantly increased.

Conclusion
The results show clearly that the supplementation (16 weeks) of a micronutrient combination will markedly improve the antioxidant vitamin status and enzyme activity. This improvement also made the red blood cells less susceptible to peroxidation by free radicals.
Macular carotenoid levels of healthy subjects and AMD patients in Japan

Macular carotenoid levels of normal subjects and age-related maculopathy patients in a Japanese population

Study design, patients and methods
In a case control study, 100 normal eyes of healthy subjects aged 20 to 80 years and 187 eyes of patients with age-related maculopathy (ARM) aged 50 to 85 years were examined. Based on a widely accepted international classification system, a distinction was made in the study between early and late ARM. The levels of macular carotenoids were measured by means of resonance Raman spectroscopy.

Results
Average levels of macular carotenoids in the healthy subjects amounted to 1,471 (± 540) Raman counts. They declined with age. Average carotenoid levels in eyes with early ARM were 620 (± 204) and in eyes with late ARM they were 427 (± 283). The levels of early and late ARM were significantly lower than the levels of healthy subjects older than 60 (1,100 ± 340). No differences were found in the carotenoid levels depending on the degree of severity of ARM or the type of choroidal neovascularisation (CNV).

Conclusion
Macular carotenoids declined in older healthy subjects. ARM patients had lower macular carotenoid levels than healthy subjects. Low macular carotenoid levels might therefore be one of the risk factors for ARM progression.
Visual performance under glare conditions: macular pigment

Macular pigment and visual performance under glare conditions

Study design, patients and methods
In an observational study the association between macular pigment (MP) and reduction in sensitivity to glare and photo stress recovery time were investigated. For this purpose, 40 healthy subjects aged 17 to 40 (23 women, 17 men), were given a supplement of lutein (10 mg) and zeaxanthin (2 mg) daily for 6 months. The parameters measured were spatial density of macular pigment, physiological glare (1st visual experiment) and recovery time after photo stress (2nd visual experiment). The subjects were tested at central and eccentric vision (10 degrees temporal retina).

Results
At baseline the optical density (OD) of the macular pigment (at 30 degree eccentricity) was between 0.08 and 1.04 and strongly correlated with an improvement in visual performance in both glare tests. After 6 months of lutein and zeaxanthin supplementation, the average macular pigment density (at 30 degree eccentricity) increased from 0.41 to 0.57, and the detrimental effects of glaring were significantly reduced in both visual performance tests.

Conclusion
The macular pigment is clearly associated with a reduction in sensitivity to glare and photo stress recovery time which strongly correlates with its spectral absorption capability and spatial profile. Four to six months of daily supplementation of 12 mg of lutein + zeaxanthin significantly increased the optical density of the macular pigment and improved the visual performance under glare conditions of most subjects.
Obesity, lutein metabolism and AMD


Summary
In her review article Johnson evaluated the role of lutein and zeaxanthin in the prevention of age-related macular degeneration (AMD), and the role of obesity as an AMD risk factor. In addition, she analysed the effect of obesity on lutein and zeaxanthin metabolism as a potential mechanism that might connect obesity with the AMD risk.

The mechanism by which obesity increases the AMD risk may be connected with the physiological changes occurring in this disease. They include oxidative stress, a higher rate of inflammation, and changes in the lipoprotein profile. These changes could result in both more severe destruction of endogenous lutein and zeaxanthin and a lower release to the macula in the eye.

Conclusion
In her article Johnson concludes that the mechanism by which obesity is associated with the AMD risk may be based on indirect effects created by changes in the lutein and zeaxanthin status and metabolism. Efforts to prevent obesity and to improve the lutein and zeaxanthin status could therefore be important for the prevention of AMD.
Effect of lutein and DHA supplementation on serum, lipoproteins and macular pigment

The influence of supplemental lutein and docosahexaenoic acid on serum, lipoproteins, and macular pigmentation


Study design, patients and methods
The randomised placebo-controlled trial investigated the isolated and combined effects of lutein (12 mg/d) and DHA (800 mg/d) on blood counts and macular pigment optical density (MPOD). Forty-nine women aged 60 to 80 years were enrolled in the trial and allocated randomly to 4 groups. The subjects received either placebo, DHA, lutein or lutein + DHA for a period of 4 months. Lutein and DHA were measured at baseline, after 2 and 4 months in serum, and lipoproteins after 4 months. MPOD was analysed at baseline and after 4 months at 0.4, 1.5, 3 and 5 degrees of eccentricity (temporal retinal).

Results
DHA supplementation had no effect on lutein levels. In the lutein group lutein levels increased from baseline until months 2 and 4 (p < 0.001), and MPOD increased at 3.0° (p < 0.01). In the DHA group the DHA levels increased after 2 and 4 months (p< 0.0001), and MPOD at 0.4° (p < 0.05). In the group taking lutein + DHA the lutein and DHA levels increased after 2 and 4 months (p < 0.01) and MPOD at 0.4°, 1.5° and 3° (p = 0.06, 0.08 and 0.09, respectively). The differences in lipoprotein subfractions compared with placebo were most pronounced in the lutein + DHA group (after 4 months). With respect to the serum DHA response, the interaction between lutein supplementation, DHA supplementation and duration of supplementation was significant (p < 0.05).

Conclusion
Supplementation of lutein alone led to an increase in eccentric MPOD in older women, whereas supplementation of DHA alone led to a central MPOD increase. The supplement combination had a combined effect on the spatial MPOD profile. Some of these results may be due to changes in the lipoproteins (via DHA).
AREDS Report No. 23: Long-chain omega-3 fatty acids and AMD

The relationship of dietary omega-3 long-chain polyunsaturated fatty acid intake with incident age-related macular degeneration. AREDS Report No. 23

Study design, patients and methods
In a prospective cohort study, the association between the intake of long-chain omega-3 fatty acids and fish and the development of neovascular age-related macular degeneration (AMD) and central geographic atrophy (CGA) was evaluated. 2,132 subjects of the Age-Related Eye Disease Study (AREDS) who were at least 71 years old and had bilateral drusen were included in the multicentre study. The primary parameters to be measured were the development of neovascular AMD and CGA. Nutrient and food intake was identified at baseline using a food frequency questionnaire which mainly recorded the supply of docosahexaenoic acid (DHA), eicosapentaenoic acid (EPA) and DHA in combination with fish.

Results
Subjects who reported the highest consumption of EPA (OR 0.44; 95 % CI, 0.23-0.87) and EPA + DHA (OR 0.45; 95 % CI, 0.23-0.90) were less prone to bilateral drusen progression tending towards CGA. DHA levels were related to CGA if the models were adjusted for the confounders of age, gender and calories (OR 0.51; 95 % CI, 0.26-1.00).

Conclusion
Dietary intake of lipids is a variable factor that may influence the probability of developing forms of AMD threatening vision. The results suggest that the dietary intake of long-chain omega-3 fatty acids is associated with a lower risk of progressive bilateral drusen tending towards CGA.
Intake of oily fish, DHA and EPA and neovascular AMD

Oily fish consumption, dietary docosahexaenoic acid and eicosapentaenoic acid intakes, and associations with neovascular age-related macular degeneration

Study design, patients and methods
In an observational study the association between the consumption of oily fish, intake of DHA and EPA and neovascular age-related macular degeneration (NV-AMD) was evaluated. Subjects from the EUREYE Study, a population-based cross-sectional study, who were at least 65 years old were included. Retinal photographs were taken, and the subjects were interviewed by means of food frequency questionnaires. Nutrient intake was evaluated from the questionnaires based on nutrient tables.

Results
Data on nutrition and retinal images were available from 105 NV-AMD patients and from 2,170 controls showing no signs of early or late AMD. The consumption of oily fish at least once per week vs. consumption of less than once per week was associated with a 50% reduction in odds ratios (ORs) of NV-AMD (OR = 0.47; 95% CI, 0.33-0.68; p = 0.002). Compared with the lowest quartile, a significant trend towards reduced ORs was observed in the higher quartiles for either DHA or EPA. ORs in the highest quartiles were 0.32 (95% CI, 0.12-0.87; p = 0.03) for DHA and 0.29 (95% CI, 0.11-0.73; p = 0.02) for EPA.

Conclusion
Consumption of oily fish at least once per week compared with consumption of less than once per week was associated with a 50% reduction in NV-AMD ORs.
Omega-3 fatty acids of marine and plant origin: A review

Omega-3-Fettsäuren marinen und pflanzlichen Ursprungs: Versuch einer Bilanz

Summary
In their contribution the authors undertake a reassessment of long-chain omega-3 fatty acids. In evidence-based guidelines, international and national societies recommend the consumption of fish (oily sea fish) at least twice per week. Sea fish, however, is declining as a source of a healthy diet due to overfishing and environmental crime in the oceans. Therefore the authors doubt whether the gap between the minimum need of 0.1 g/day which, as they believe, is not covered by the diet of large parts of the population, and the optimal need of 1 g/day can be closed. For several reasons, vegetable oils rich in alpha-linolenic acid (ALA) are not an adequate source of long-chain omega-3 fatty acids. But they can be a valuable supplement in manageable amounts. In 2000 for the first time, fish oil capsules besides oily sea fish were included in the AHA recommendations for secondary prevention of CVD. Compared to high-ALA vegetable oils, they offer the advantage of allowing precise dosage, need only be taken in small amounts and thus do not challenge the limit of 30 energy percent of total fat intake. This means that eating habits need not be radically changed when omega-3 is taken in a concentrated form.

Conclusion
The authors conclude that the biological need for long-chain omega-3 fatty acids should be covered in future by a mixed supply concept allowing an individual variation of fish, fish oil, high-ALA vegetable oils, functional food and food supplements as a source of omega-3 fatty acids. In this way the culinary wishes and economic possibilities of each individual could be taken into account.
High homocysteine, low vitamin B₁₂ and folic acid levels and AMD: The Blue Mountains Eye Study

Elevated serum homocysteine, low serum vitamin B₁₂, folate, and age-related macular degeneration: The Blue Mountains Eye Study

Study design, patients and methods
In a population-based cross-sectional study, the relationship between elevated serum homocysteine, low vitamin B₁₂ and low folic acid levels and age-related macular degeneration (AMD) was evaluated. For this purpose, the serum homocysteine, vitamin B₁₂, and folic acid levels of 2,335 participants in the Blue Mountains Eye Study (second survey) were measured. Age-related macular degeneration was identified on the basis of retinal images and included atrophic or neovascular lesions.

Results
In logistic regression models (after adjustment for the confounders of age, gender, smoking), homocysteine levels of more than 15 μmol/L were associated with a higher probability of AMD development in subjects below the age of 75 (OR 3.21; 95 % CI, 1.09-9.43). A similar correlation was found in all subjects for vitamin B₁₂ levels of less than 125 µmol/L (OR 2.30; 95 % CI, 1.08-4.89). In subjects with homocysteine levels of ≤ 15 μmol/L lower B₁₂ levels were related to almost 4 times higher ORs of AMD (OR 3.74; 95 % CI, 1.06-13.24).

Conclusion
In this study population, elevated serum homocysteine and low serum vitamin B₁₂ levels were associated with a higher AMD risk independently of each other.
CRP and homocysteine: association with dietary and behavioural AMD risk factors

C-reactive protein and homocysteine are associated with dietary and behavioral risk factors for age-related macular degeneration


Study design, patients and methods
The study aimed at investigating if there is a connection between age-related macular degeneration (AMD) and highly sensitive C-reactive protein (CRP), homocysteine and systemic biomarkers for cardiovascular diseases. For this purpose, the data of 934 subjects (with and without age-related macular degeneration) of the AREDS (Age-Related Eye Disease Study) cohort study were evaluated. Risk factors and biomarkers were determined on the basis of questionnaires, direct measurements or blood samples.

Results
Higher serum levels of the antioxidants vitamin C and lutein/zeaxanthin and a higher intake of fish were associated with lower CRP, whereas serum vitamin E, smoking and an elevated BMI were associated with elevated CRP. Serum vitamin E and alpha carotene and the intake of antioxidants and vitamin B12 with the diet were associated with lower plasma homocysteine levels, whereas high blood pressure correlated with elevated homocysteine levels.

Conclusion
C-reactive protein and homocysteine levels are related to dietary and behavioural factors which are associated with age-related macular degeneration.
Vitamin B status and homocysteine and methylmalonic acid levels in older women

B vitamin status and concentrations of homocysteine and methylmalonic acid in elderly German women


Study design, patients and methods
In an observational study, the dietary supply and blood levels of various B vitamins, total homocysteine (tHcy) and methylmalonic acid (MMA) were measured in 178 older women (60-70 years). Information about their diet was provided by a three-day nutrition protocol. In order to determine the status of the three vitamins thiamine, riboflavin and vitamin B6, the respective activity coefficients of erythrocyte transketolase, erythrocyte glutathion reductase and erythrocyte alpha-asparagine aminotransferase were used as functional indices. Folic acid was measured in serum and in red blood cells, cobalamin and MMA in serum and tHcy in plasma.

Results
The thiamine, pyridoxine and cobalamin indices were insufficient in two thirds of the women, whereas tHcy and MMA levels were elevated in 17.4% and 9.6%, respectively. A correlation between vitamin intake and blood vitamin levels was only found for folic acid. The average tHcy levels of the subjects in the lowest serum folic acid level quartile was 23% above that of the subjects in the highest quartile. MMA correlated positively with age and inversely with serum cobalamin levels.

Conclusion
Even in younger well educated senior women a prevalence for a low vitamin B status and elevated plasma tHcy levels was identified. From the authors’ point of view, supplementation of thiamine, pyridoxine, folic acid and cobalamin should therefore be considered.
New findings on vitamin D and vitamin B\textsubscript{12}


**Summary**

In their contribution the authors provide an overview of current findings concerning the adequate supply of vitamins D and B\textsubscript{12}.

Vitamin D supply in Germany is considered adequate for the most part, although on average the intake with the diet is far below the recommended 5 μg/d. Difficulties to reach this level exist in the winter months and for certain risk groups which include older and hospitalised persons with low UV exposure. To ensure a good supply, a vitamin D intake of 10 μg/d is recommended for persons older than 65, a level which, according to the authors, cannot be obtained with the diet. However, in view of the preventive effects, a supply going far beyond the current recommendations and amounting to as much as 25 μg/d appears to be desirable (particularly in the months with little sunshine).

Besides vitamin D, vitamin B\textsubscript{12} also is becoming increasingly important in geriatrics. Although in Germany the intake of vitamin B\textsubscript{12} with the diet is mostly adequate, this does not mean that older people are well supplied. Chronic atrophic arthritis often developing in old age reduces the secretion of gastric juice and pepsinogen which are required for utilizing the vitamin taken up with the diet. Even if the dietary vitamin B\textsubscript{12} supply reaches the calculated levels and is thus considered adequate, deficiencies are to be observed in seniors. Up to 43% of the population above the age of 60 are affected by a subclinical vitamin B\textsubscript{12} deficiency, as current studies have shown. The authors believe that people beyond the age of 60 should therefore be advised to routinely take vitamin B\textsubscript{12} (>50 μg/d).

**Conclusion**

The authors conclude that especially in the winter months there are many good reasons for a vitamin D intake of 25 μg/d. This, they say, particularly applies to older people with too little exposure to sunlight in general and a reduced endogenous vitamin D synthesis. Likewise a general vitamin B\textsubscript{12} supplementation (>50 μg/d) should be considered from the age of 60, because in old age the vitamin B\textsubscript{12} supplied with the diet is often poorly utilized.
Vitamin D and AMD in the Third NHANES 1988-1994

Association between vitamin D and age-related macular degeneration in the Third National Health and Nutrition Examination Survey, 1988 through 1994

Study design, patients and methods
In the context of the Third National Health and Nutrition Examination Survey (NHANES III), the association between serum vitamin D levels (25 hydroxy vitamin D) and development of age-related macular degeneration (AMD) was investigated. In this connection a multi-stage representative random sample of 7,752 people (of them 11% with AMD) was assessed over a period of 6 years.

Results
Serum vitamin D levels were inversely related to early, but not to advanced, AMD. The odds ratio (OR) for early AMD was 0.64 (95% CI, 0.5-0.8; p-trend < 0.001) for subjects in the highest vs. the lowest vitamin D quartile. Explorative analyses were made to identify the association with important food items and supplement sources providing vitamin D. It was found that milk intake and early AMD (OR 0.75, 95% CI, 0.6-0.9) and fish intake and advanced AMD (OR 0.41, 95% CI, 0.2-0.9) were inversely correlated. In subjects not consuming milk daily, regular use of vitamin D supplements vs. no such supplementation was inversely correlated with early AMD (early AMD: OR 0.67; 95% CI, 0.5-0.9).

Conclusion
The study proved an inverse relationship between AMD and higher serum vitamin D levels and higher milk intake. Lower AMD prevalence was observed in subjects who took vitamin D supplements regularly and did not consume milk daily. The authors believe that vitamin D can protect the eyes against AMD.
The Orthomol® Vision AMD Service has compiled a survey of recent contributions on the subjects listed here for healthcare professionals. The abstracts of articles published in renowned specialist journals will help you obtain a general view of these topics.

Supplementation of micronutrients that are especially important for our eyes is an essential part of a comprehensive treatment concept of age-related eye diseases.