

# ALTERNATIVE MEDICINE ALERT®

The Clinician's Evidence-Based Guide to Integrative Medicine

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## INSIDE

Vitamin D may lower the risk of dementia page 53

Mindfulness based stress reduction: Non-doing for well-being page 56

CME questions page 60

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## Yoga for Weight Loss

By Judith L. Balk, MD

Dr. Balk is Associate Professor, Magee-Women's Hospital, University of Pittsburgh; she reports no financial relationship to this field of study.

**Synopsis:** Weight loss and weight maintenance are often difficult to achieve. Although exercise is recommended as one of the mainstays of treatment, many overweight people have difficulty finding a feasible and enjoyable form of exercise. Yoga, with its physical postures, breathing techniques, relaxation training, and nonreactive mindset, may be an effective approach to help with weight loss. This article summarizes the evidence for yoga as part of a weight management regimen.

HEALTH CARE COSTS ARE HIGHER FOR OBESE PATIENTS THAN FOR non-obese patients, in part due to higher use of conventional medical care.<sup>1</sup> However, effective medical treatments for obesity are limited, so one might postulate that obese patients would be more likely to try complementary and alternative medical (CAM) approaches for treatment of obesity. However, one large survey, the National Health Interview Survey, compared the use of CAM between normal-weight individuals and those who are overweight, mildly obese, moderately obese, and extremely obese.<sup>1</sup> Although obese adults have greater illness burden and higher utilization of traditional medical care, they are not more likely to use CAM approaches. Obese adults have a similar prevalence of CAM modality use, including relaxation techniques, botanicals, massage, chiropractic, and acupuncture. Interestingly, tai chi was as commonly used in obese as in normal-weight individuals, but adults with obesity have a lower prevalence of the use of yoga. This cross-sectional survey does not indicate whether those who are obese choose not to do yoga, or whether yoga effectively treats obesity, but it does indicate an inverse association between obesity and the use of yoga. Some forms of yoga may also be difficult due to an obese body habitus.

On a very basic level, weight gain is due to higher caloric intake relative to lower caloric expenditure, although many other factors are important, such as the quality/type of the calories. When considering both caloric intake and expenditure, the two most important

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## Summary Points

- Yoga, which promotes energy expenditure while reducing energy intake, may be effective for weight loss.
- Yoga is associated with reduced risk factors for cardiovascular disease and diabetes mellitus.
- Since research supports yoga's benefits on flexibility, strength, balance, and stress reduction, recommending yoga to overweight patients is reasonable.

factors are diet and exercise. However, diet and exercise have many component factors, and obesity is considered to be multifactorial. For instance, genetic predisposition, sedentary lifestyle, overeating, fast food diet, increased portion size, and marketing of unhealthy foods all may play a role in obesity.<sup>2</sup> A seemingly "simple" recommendation is to reduce energy intake and to increase energy expenditure. However, this "simple" recommendation is difficult to implement, especially when one is overweight, because energy expenditure, for instance exercise, can be difficult. A holistic approach, such as yoga, that promotes energy expenditure while reducing energy intake may be effective for weight loss. Interestingly, long-term yoga practitioners at a residential yoga center in Bangalore had a lower basal metabolic rate compared to non-yoga practitioners with similar lifestyles.<sup>3</sup> This lower metabolic rate may be due to reduced overall arousal, although basal metabolic rate adapts to the nutritional status and physi-

cal activity of the individual. No evidence suggests that a casual yoga student lowers his or her metabolic rate; perhaps yoga practitioners who have chosen to live in a residential yoga center have chronically lowered metabolic rates due to chronically low stress.

Hatha yoga is a combination of breathing exercises (pranayama), relaxation techniques, and physical postures (asanas). Yoga also may include various lifestyle guidelines such as vegetarianism and clean eating. Thus, yoga practitioners may choose food that is of higher quality. Yoga is historically considered to help reduce stress, increase mindfulness, and improve fitness, flexibility, and mood.<sup>2</sup> Obesity and overweight may be reduced with improved stress coping by reducing emotional eating. Similarly, mindful eating may reduce overall caloric intake, and improved fitness may increase caloric expenditure. In addition, yoga indirectly may improve body weight via its emphasis on developing body awareness and physical discipline.<sup>4</sup> Yoga practitioners consistently note that they feel "more connected" to their bodies<sup>4</sup>; overeating may then be more uncomfortable for one who is more aware of bodily sensations. Thus, it is possible that yoga could decrease weight. However, little rigorous research has been published specifically on yoga for weight loss.

## Clinical Research

Mindfulness is described as nonjudgmental awareness of the present moment, and it is associated with many positive health outcomes.<sup>5</sup> Specifically for obesity, mindfulness during eating may be associated with noting satiety or being aware of hunger vs boredom as cues to eat. Yoga in general cultivates a mindful and non-judgmental attitude during yoga practice, and the effects of this may spill over into non-yoga class time, as detailed below. Mindful eating skills differ from cognitive weight management skills such as maintaining food diaries and counting calories. For instance, eating after feeling full and eating quickly are both factors associated with lower mindfulness. Yoga, walking, and other types of exercise were evaluated regarding mindful eating practices. Both the years of yoga practice and the number of minutes of yoga practice per week were associated with higher mindful eating scores. Other physical activity was not associated with mindful eating, with the exception of walking more than 200 minutes per week, which the investigators thought was a statistical chance finding. In addition, those with higher mindful eating scores had lower body mass indices. Mindful eating may be one mechanism by which yoga may improve weight.

The effects of yoga on body composition, cardiovascular endurance, and anaerobic fitness were evaluated in boys age 12 to 15.<sup>6</sup> Participants were randomized to one-year yoga training, 45 minutes per day, for 3 days per week. Participants in the control group were sedentary.

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At the end of the intervention period, the yoga practitioners had significantly lower body fat percentages than the control group. Cardiovascular endurance, as measured by a step test, and anaerobic power, as measured by a jump test, were also significantly better in the yoga group compared to the control group. Obviously, the sedentary control group would not be expected to show improvement in fitness; however, given the sedentary nature of many people today, this study does show a difference that could be clinically relevant. An interesting demographic: Not many clinicians would likely access this population and recommend yoga, so the results are not highly generalizable.

Adolescents with obesity may be best treated with behavior modification approaches, teaching the children to adopt a healthy lifestyle. A randomized controlled trial enrolled obese adolescents and compared those randomized to a behavior modification program and those in the control group.<sup>7</sup> The behavior modification program included 4-hour structured sessions that were held weekly for 16 weeks, and each session involved 2 hours of behavior modification or dietary instruction and 2 hours of yoga therapy. The participants also visited a dietician four times during the program. Eating behavior was measured via the Dutch Eating Behaviour Questionnaire, a validated scale that measures three components of eating behavior: emotional, external, and restrained eating. Emotional eating is eating in response to emotional states such as fear and anxiety. External eating is eating in response to external food cues such as the sight or smell of food, and restrained eating is overeating when the cognitive resolve to minimize food intake is abandoned. The experimental group lost significantly more weight than the control group, and they experienced improvements in emotional eating, external eating, and restrained eating significantly more than the controls. Yoga was one component of the intervention, and it is unknown how much each of the components contributed to the weight loss and eating behavior changes.

A smaller study in Hispanic youth also noted improvement in weight with Ashtanga yoga practice over a 12-week period.<sup>8</sup> Average weight loss over the 12 weeks was 4.4 pounds, which was statistically significant from baseline. Four of the five children with low self-esteem at baseline improved. Two of the 14 subjects had decreases in self-esteem compared to baseline. The investigators postulate that these declines may be due to the humbling experience of yoga practice, where some of the children may have realized that they could not achieve certain poses or that they progressed slower than their peers. The investigators also note that with additional yoga practice, participants may be able to improve their poses while being more able to accept their limitations. Anxiety also improved in those with baseline anxiety. Limitations of this study include the single-group, lack of long-term follow

up, and the small sample size.

The Vitamins and Lifestyle (VITAL) study was a large questionnaire-based study, and one analysis focused on yoga and weight change over midlife, ages 53 to 57.<sup>4</sup> More than 15,000 participants were analyzed for weight and weight change, yoga and physical activity, and diet, using a linear regression analysis. Among both normal and overweight participants, lower weight gains were associated with increasing intensity of yoga practice, with larger associations for those who were overweight. For instance, for those who were overweight at age 45, there was an 18.5 pound lower weight gain for long-term yoga practitioners compared to non-practitioners. Food intake only explained 1.2 pounds of this difference. The main limitations of this study are that it used self-administered questionnaires and self-reported weights, the data are retrospective, and it isn't immediately obvious that they controlled for confounding variables.

Physical activity is difficult in obese patients, and exercise programs must be tailored for them. A prospective single-group clinical study enrolled 47 obese participants in a 6-day residential treatment program including seated yoga and dietary changes.<sup>9</sup> Compared to baseline measures, body mass index, lean body mass, waist and hip circumferences, total and HDL cholesterol, and leptin levels all decreased. Hand grip strength and balance increased. The investigators note that not all of the changes were beneficial, specifically the decreases in HDL and in lean body mass, and that these changes may be related to the drastic change in diet.

To find meaningful reductions in weight, longer term studies must be completed. In the shorter term, yoga is associated with reduced risk factors for cardiovascular disease and diabetes mellitus. In one study, 98 subjects enrolled in an outpatient 8-day lifestyle modification program based on yoga principles.<sup>10</sup> The intervention included physical postures, breathing exercises, relaxation techniques, education, and group support. There was no control group, and a pre-post analysis evaluated differences from baseline to the end of the intervention. Subgroup analysis defined those with abnormal fasting glucose and cholesterol at baseline. In these higher-risk groups, fasting glucose, total and LDL cholesterol, and triglycerides were all significantly lower at the end of the intervention compared to baseline, and HDL cholesterol was significantly higher. Although this short-term study did not evaluate weight, it did show improvements in variables associated with obesity.

An important component of yoga is relaxation training. In some patients, inadequate coping with stressful events leads to overeating, and learning how to cope in other ways may be beneficial for these patients. Relaxation techniques can aid patients in changing their re-

sponses to stress, for example avoiding emotional eating.<sup>11</sup> The effects of relaxation training were studied in 60 inpatient obese women who reportedly were emotional eaters.<sup>12</sup> The patients were admitted for weight reduction treatment and rehabilitation. Participants were randomized to one of three groups: individual relaxation training sessions, virtual reality sessions, or control, who received only standard hospital-based care. Weight decreased in all three groups, likely due to the common treatment all inpatients received. Relaxation training reduced emotional eating episodes, depressive and anxiety symptoms, and improved perceived self-efficacy for eating control. The virtual reality condition decreased emotional eating more than the relaxation training. While the relaxation training sessions differed from yoga sessions, the findings may be applicable to relaxation training in general.

The long-term success of weight loss is fairly low, meaning most of the lost weight is regained within five years.<sup>13</sup> Finding a “non-diet” approach that is consistent with a healthy lifestyle may be most beneficial for maintaining weight loss. Stress reduction training can lead to improvement in stress management behaviors and symptom discomfort; it can also lead to improved self-efficacy for low-fat eating.<sup>13</sup> While one randomized study did not show a difference in weight loss between three different stress reduction interventions, benefits in behavior were noted.<sup>13</sup> Changing behaviors to more beneficial behaviors may have long-term benefits. One randomized study comparing yoga to cognitive behavioral therapy found that both interventions equally reduced both psychological measurements, such as self-rated stress and quality of life, and physical measurements of stress such as urinary catecholamines and salivary cortisol.<sup>14</sup>

Breathing techniques, called pranayama, are also a standard part of yoga practice. Breathing techniques are not usually done alone, but one study evaluated a specific breathing exercise as a treatment for obesity.<sup>15</sup> This breathing exercise is called “Senobi,” and it includes stretching the arms above the head and arching the back, similar to a back extension with pranayama, as in yoga. The investigators note that this exercise “could activate or recover sympathetic nervous system activity that leads to the loss of body weight.”<sup>15</sup> Using heart-rate variability testing, the investigators found that overweight women had less sympathetic nerve activity compared to “healthy” women. After one minute of Senobi breathing, up-regulation of sympathetic nerve activity and increased urinary noradrenaline, estradiol, and growth hormone occurred. After one month of using the Senobi breathing method three times per day, obese women had a statistically significant loss of body fat, from 39% to 35.8%. No side effects were discussed. While most physicians aim to teach relaxation training to decrease sympathetic output, this study is noting that increasing sympathetic output will

help weight loss. How this relates to chronic stress and obesity is unknown.

## Conclusion

Yoga does not include a calorie-restricted diet, even though some studies suggest that it helps with weight loss. Because yoga is multidisciplinary, often including changes in behavior, stress levels, and diet, it is impossible to determine if one aspect of yoga is “the active agent.” It is very difficult to study in rigorous controlled research. Yoga is a type of lifestyle exercise that most patients can safely practice, even as elders.

The components of Hatha yoga, including physical exercises, relaxation training, and breathing techniques, each potentially could improve weight management. Studying Hatha yoga is difficult to do, because masking subjects to treatment group and finding a valid, inactive placebo is difficult. Also, many different forms of yoga exist, such as Iyengar, Hatha, Ashtanga, and Kundalini, and it is possible that some are better than others for weight loss. More research is necessary to make firm conclusions about yoga’s effects on weight loss. However, enough research is supportive of yoga’s benefits on flexibility, strength, balance, and stress reduction that recommending yoga to our overweight patients seems reasonable.

## Recommendations

In general, learning yoga under the care of a qualified yoga teacher is necessary,<sup>16</sup> especially for those with medical conditions or those who are very deconditioned. Precautions for yoga include avoidance of fatigue and pain, and that physical postures (asanas) should be done at one’s own pace. Postures can be modified or assisted as necessary.<sup>16</sup> For the obese patient, we can recommend yoga provided that it is done under the care of a qualified teacher. ■

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## Vitamin D May Lower the Risk of Dementia

By David Kiefer, MD

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YOU SAW THE TITLE AND PROBABLY SAID TO YOURSELF “Really? Another use for the star vitamin, vitamin D?” Indeed; it’s true. Branching out from bones, autoimmune

diseases, and cancer, the neuroprotective effects of vitamin D are intriguing, and the clinical trials examining associations and causation of vitamin D and dementia are worth our attention. Previous issues of *Alternative Medicine Alert* (see July 2010, December 2010, and February 2011 issues) have examined the connection between serum 25-hydroxyvitamin D (25(OH)D) or vitamin D supplementation and various medical conditions. Below, however, is a summary of the brain-relevant mechanisms and research, including usable pearls and what future neurological data may help to refine this aspect of the 21st century’s favorite micronutrient.

### Physiology and Mechanism of Action

There are many proposed connections between serum 25(OH)D, more physiologically active forms of vitamin D, and central nervous system physiology. First of all, and a crucial component of the relevancy of vitamin D’s effects on the brain, vitamin D receptors (VDR) are found in neuronal and glial cells crucial for cognition.<sup>1</sup> For example, the cerebral cortex and cerebellum have vitamin D receptors and 1-alpha-hydroxylase (an enzyme that acts upon vitamin D), possibly indicating that the brain is able to convert 25(OH)D to more active forms locally.<sup>2,3</sup> Interestingly, people with Alzheimer’s disease (AD) may have a reduction in the expression of VDR in different layers of the hippocampus,<sup>3,4</sup> further evidence of a role for vitamin D in memory.

Animal and basic science research have found that vitamin D may prevent the degeneration of neurons by helping to clear beta-amyloid, assist in detoxification of nerve tissue, maintain calcium homeostasis, and through the expression of neurotrophic factors such as neurotrophin-3 and glial cell line derived neurotrophic factor.<sup>1,5,6</sup> More specifically, vitamin D may protect the brain directly by decreasing oxidation and inflammation and improvement in neuron health, and indirectly via decreased peripheral artery disease and cerebrovascular and cardiovascular disease.<sup>1,6</sup> Vitamin D also may provide neuroprotection by inhibiting nitric oxide synthase and upregulating enzymes involved in glutathione synthesis.<sup>1,6</sup>

### Clinical Research

Clinical research relevant to vitamin D and dementia falls generally into two main categories. First, there are cross-sectional retrospective studies looking to find an association, and relative risk (RR), between vitamin D intake or serum 25-hydroxyvitamin D (25(OH)D) and either rates of dementia or cognitive impairment. Second, case-control retrospective or prospective studies exist, usually examining cohorts of people ingesting different amounts of vitamin D and connections with rates of dementia. In either case, one challenge in comparing the dif-

## Summary Points

- People with Alzheimer's disease may have a reduction in the expression of vitamin D receptors in different layers of the hippocampus.
- A recent review found mixed results concerning the effect of vitamin D on cognitive performance.
- Clinical trials, and common sense, suggest that prudent exposure to sunlight may improve serum vitamin D levels and thus improve cognition.

ferent trials is the variety of neuropsychiatric tests used to quantify cognition and clinical dementia.

A recent review found only five studies, none of which were longitudinal prospective cohort studies (a higher quality of clinical evidence), that had adequate controls and statistical analyses detailing 25(OH)D connections with cognitive performance.<sup>3</sup> Overall, the results were mixed, with some trials finding a connection, and others failing to find any effect of vitamin D levels on cognitive performance. The trials, as mentioned above, used a variety of clinical tests to assess cognition; this could explain the disparity in results. Also, some trials controlled for known dementia confounders, and in others there were different cutoffs for what is considered sufficient or insufficient vitamin D levels. The latter point is relevant mostly because some trials did their regression analyses on groups of people within a certain range of serum 25(OH)D (rather than as a continuous variable), so such thresholds will directly affect how the data are analyzed. The most convincing positive associations seemed to be in studies that tested subjects' global cognitive functioning with composite neuropsychiatric tests, rather than specific aspects of cognition (i.e., executive and learning functions), leaving the researchers unable to definitively say which aspects of brain function could be affected by vitamin D.

As an example of the most simple approach to establishing a vitamin D correlation, researchers did a retrospective chart review of 80 patients from a consultative memory clinic, 40 of whom had documented serum 25(OH)D values.<sup>7</sup> There was statistically significant positive correlation between serum 25(OH)D and Mini-Mental Status Examination (MMSE) score ( $P = 0.006$ ), an interesting result but, of course, one that does not begin to explain mechanism nor comment on any possible causation.

Slightly more involved, one cross-sectional study measured the serum 25(OH)D of 100 patients with Parkinson's disease and compared them to values for 100 matched controls and 100 people with AD.<sup>8</sup> Focusing on the AD component of the results, 41% of the AD patients

had vitamin D insufficiency ( $< 30$  ng/mL), not significantly different from the controls, but interestingly, significantly higher than the Parkinson's disease patients (55%,  $P = 0.05$ ). The authors offer several explanations for why Parkinson's disease, but not AD, may have such a high proportion of vitamin D insufficiency, including physiologic differences (particularly high concentrations of VDRs in substantia nigra), and reasons why Parkinson's disease patients may get less sun exposure than AD patients. The small sample size of this trial and weak statistical correlation may be the simple explanation for some of the findings.

Patients enrolled in an AD research center were part of a cross-sectional study.<sup>9</sup> Eighty ambulatory people (40 with AD, 40 controls) 60 years or older had MMSE, Short Blessed Test (SBT), Clinical Dementia Rating (CDR), mood disorder assessments, and serum 25(OH)D measurements. Among tertiles of 25(OH)D, vitamin D deficiency was correlated with the presence of mood disorders, and one aspect each of SBT ( $P = 0.0436-0.002$ ) and CDR ( $P = 0.033$ ), but not with the MMSE.

Other researchers have taken a different track in trying to find the dementia-vitamin D connection. Three hundred eighteen people (75% women, mean age 73 years) receiving home care services in Boston participated in a cross-sectional study and had neuropsychological testing, blood tests, and brain imaging.<sup>6</sup> In this group, 76 people had dementia (from any cause), 44% of the total were vitamin D insufficient ( $< 20$  ng/mL), and 15% were deficient ( $< 10$  ng/mL). Patients with vitamin D insufficiency had more than twice the risk of all-cause dementia (odds ratio [OR] = 2.6; confidence interval [CI] = 1.5-4.7), even after adjusting for confounders. Interestingly, the connection to AD specifically became insignificant (OR = 2.7; CI = 0.99-7.2) when an adjustment was made for all possible confounding variables. Also, white matter volumes (as per MRI), an indicator of vascular pathology, were inversely proportional to serum 25(OH)D, confirming what the authors hypothesize as a vascular connection to how vitamin D protects against dementia.

One research group examined the connection between vitamin D deficiency (serum 25(OH)D  $< 10$  ng/mL) and impaired cognition as quantified by a Pfeiffer Short Portable Mini Mental Questionnaire score  $< 8$  in 752 women at least 75 years old in France.<sup>4</sup> Detailed information regarding possible confounding variables was collected and incorporated into the statistical analysis. One hundred twenty-nine women had vitamin D deficiency and they also had lower Pfeiffer scores ( $P < 0.001$ ), though there did not seem to be a linear relationship between these two variables. Overall, even after adjusting for confounding variables, vitamin D deficiency was associated with almost two times the risk of impaired cognition (OR = 1.99, CI = 1.13-3.52,  $P = 0.017$ ).

Moving over to Italy, researchers examined a database of 858 adults age 65 or older over a 6-year period, comparing rates of substantial cognitive decline (a 3 point drop in the MMSE) in those people with severely deficient serum 25(OH)D (< 10 ng/mL) to those with sufficient levels (at least 30 ng/mL).<sup>5</sup> The RR of cognitive decline for people who were severely vitamin D deficient was 1.6 (CI = 1.19-2.00). This change is interesting as the deficient group started at a statistically significant lower MMSE score than the sufficient group (23.7 vs 26.3,  $P < 0.001$ ). The researchers adjusted for a variety of confounders, finding that the association remained true. Positive aspects of this study include the use of the MMSE, of which many clinicians are familiar, and the prospective design, allowing the researchers to feel more comfortable saying that the association observed was not due to reverse causation. In the discussion, the researchers hypothesized that their results are consistent with some past research showing more of a detrimental effect of low vitamin D on “executive functions” rather than “...other cognitive domains such as memory...” though they clearly state that more research is needed to clarify this.

Not to ignore the male gender, other researchers measured serum 25(OH)D in 1604 community-dwelling men age 65 and over and quantified cognitive function with two standardized tests (the Modified MMSE and the Trail Making Test Part B), following them prospectively for 4.6 years.<sup>10</sup> Statistical analyses were done on serum 25(OH)D quartiles, with the lowest quartile < 20 ng/mL and the highest, or reference, quartile > 29.7 ng/mL. An increased odds of cognitive impairment (as per the Modified MMSE) existed across the quartiles, but the trend was not statistically significant and disappeared completely when adjusting for educational level and race. At the follow-up visit, lower serum 25(OH)D and odds for cognitive decline again displayed a trend that was not statistically significant ( $P = 0.08$  for the trend).

### **Vitamin D Supplementation and Cognition**

The medical literature is minimally useful in helping us answer this question; clearly more prospective clinical trials are necessary. One study gave 50,000 IU of vitamin D<sub>2</sub> orally three times weekly for 4 weeks to 63 nursing home residents.<sup>11</sup> This dosing repleted their serum 25(OH)D adequately, but after the treatment period there was no improvement in animal fluency, clock drawing, nor neuropsychiatric inventory. It is likely that the small sample size and short study duration are factors that may explain the lack of cognitive improvement in this group. No adverse effects were thought to be due to the vitamin D<sub>2</sub>; several adverse effects occurred in this study, but they were in the comparison group.

### **Dosage and Administration**

A prior issue of *Alternative Medicine Alert* (see July 2010 issue) reviewed the current dosing recommendations for specific disease conditions. With respect to dementia, it is difficult to draw conclusions from the cross-sectional retrospective trials. The few prospective trials followed serum 25(OH)D, not supplemental vitamin D.

We have options for achieving improvements in serum 25(OH)D that hopefully will translate into improvements in cognition. As our common sense would dictate, and clinical trials support, prudent exposure to sunlight may help. In fact, one study in hospitalized, elderly women with Alzheimer’s disease showed improvements in serum vitamin D levels, and an improvement in bone mineral density, with regular sunlight exposure (3615 minutes yearly).<sup>12</sup> Baseline 25(OH)D of 9.6 ng/mL increased to 20.9 ng/mL.

### **Conclusion**

There are convincing mechanistic data for how vitamin D could influence neurologic function and help prevent or treat symptoms of dementia. There are VDR in key places in the brain, and vitamin D serves to protect neurons from oxidative damage (via glutathione), inhibit calcium increases that can be damaging to cells, foster neurotrophic factors, and indirectly assist in brain function through vascular effects. Most of our clinical data is looking at associations between serum 25(OH)D and cognitive function as elucidated through primarily cross-sectional research. The results have been all over the map, sometimes, but not always, showing negative effects on MMSE and other tests with low serum 25(OH)D. In some trials, the odds of all-cause dementia and/or AD is higher with vitamin D deficiency, but this also differs study by study. There is debate about the specific type of cognitive function affected by vitamin D. However, there is general consensus about an increased odds of cognitive impairment with vitamin D deficiency (< 10 ng/mL). Absolutely, it would be helpful to see more prospective trials of vitamin D supplementation on the prevention or treatment of dementia.

### **Recommendation**

There are many reasons to avoid vitamin D deficiency, from adverse effects on bone health, to an increased fall risk, and, now, despite the conflicting research, probable adverse effects on neurons that may be connected with cognitive decline, if not overt dementia. One vitamin D expert publicly vouches for its safety, even in moderately high daily doses.<sup>13</sup> If he is right, and there are many others who support the need to supplement beyond the paltry RDA, then one clinical track to take, especially in anyone in an at-risk demographic for dementia, would be to test

serum 25(OH)D and treat until the patient is in the vitamin D sufficient range (> 30 ng/mL), well out of the range of the increased odds of cognitive impairment that were seen in some of the studies reviewed in this article. Alternatively, prudent sunlight exposure throughout the year, as demonstrated in one trial, could help people to achieve sufficient serum 25(OH)D levels. This approach seems to be safe and possibly effective at avoiding adverse neuron effects from low vitamin D, as we await more well-designed prospective trials that guide our vitamin D prescribing practices. ■

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# Mindfulness Based Stress Reduction: Non-doing for Well-being

By Nancy J. Selfridge, MD

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**Synopsis:** *Mindfulness Based Stress Reduction (MBSR) research over 30 years has explored its potential benefits for mood disorders, chronic medical illness, and pain as well as mental and physical health for non-medical populations. Newer data suggest additional applications. Though research is limited by methodological flaws, MBSR is a low-risk intervention that may be helpful for a wide variety of patient problems.*

## History and Background of MBSR

MINDFULNESS IS A TERM USED TO DEFINE A STATE OF FOCUSED attention that can be described as awareness of experience without evaluation or judgment. It has its origin in Buddhist tradition, where the practice of several meditation exercises are endorsed as training to allow more adept access to this mental state. From the Buddhist perspective, proficiency in mindfulness is believed to foster clarity of thinking and compassion, as well as to alleviate suffering and to promote well-being. Other common monikers for this mental state in the meditation literature include "being in the present moment," "nonjudgment," "nonattachment," "nonstriving," and "nondoing."

Interest in mindfulness meditation as a therapeutic intervention for medical and psychiatric problems has increased over the last 30 years or so. In addition, as functional neuro-imaging tools have evolved, neuroscientists investigating neural correlates of consciousness and affect regulation have become curious about how meditation and mental training alter these same correlates.

In 1979, Jon Kabat-Zinn began offering a secular course of mindfulness training called Mindfulness Based Stress Reduction (MBSR), through the Stress Reduction Clinic at University of Massachusetts Medical Center. Within a few years, he began publishing descriptive data

## Summary Points

- Proficiency in mindfulness is thought to foster clarity of thinking and compassion, to alleviate suffering, and to promote well-being.
- Studies have shown physiologic effects of mindfulness based stress reduction including increased natural killer cell function, enhanced antibody response, reduced inflammatory cytokine levels, increased heart rate variability, and reduced serum cortisol levels.
- Potential clinical situations where mindfulness based stress reduction might be beneficial include pain, anxiety, depression, and cancer.

about the effects of mindfulness training in patients with chronic pain, mood disturbances, and stress symptoms.<sup>1</sup> The MBSR program is currently offered worldwide in more than 200 medical centers, hospitals, and clinics. There are other ways to become trained in mindfulness, many of them with the guidance of well known Buddhist teachers, such as Thich Nhat Hanh and Pema Chodron. However, MBSR offers a standardized program that has been widely and frequently studied since its introduction and its training and practice require no religious or philosophical affiliation.

### Description of Course

MBSR is an 8-week structured course of training in mindfulness. Participants go through a pre-course screening interview with a course instructor to review the requirements of the course and to discuss the participants' motivations and expectations for course attendance. Participants are required to attend eight weekly 2 1/2 hour sessions and participate in an all-day mindfulness retreat. Make-up sessions for any missed classes are encouraged. Formal mindfulness meditation techniques are taught, including sitting meditation, body scan, and gentle Hatha yoga postures. Mindfulness practices applied to daily life experiences, such as eating and walking, are explored. Written documentation of daily practice of the techniques learned in class is endorsed during the course period. Audiotapes or CDs often are provided to participants to help guide home practice. Instructors are formally trained in an MBSR instructor course and are experienced meditators, committed to their own meditation practice.

### Mechanisms of Action

Though meditation practice can lead to a deep state of physiologic relaxation, this is not the primary focus of the training and practice. In fact, MBSR trainees are encouraged to abandon any striving for a release of body or men-

tal tension, instead cultivating an increased awareness of all physical, mental, and emotional experiences during the practice exercises without associated value judgments or interpretation. The development of this metacognitive skill then allows a participant to observe how both positive and negative sensations, emotions, and thoughts come and go, moving one beyond reflexive thinking and behavior. The neural and physiologic correlates of this state of mind are a subject of great interest. Though not all of the following research is specifically relevant to the MBSR course, it is still helpful in formulating hypotheses about how mindfulness meditation interventions may exert their effects.

EEG studies show enhanced alpha and theta activity during meditation. Neuroimaging studies have shown that mindfulness meditation practice activates the prefrontal cortex and anterior cingulate cortex.<sup>2</sup> Functional connectivity appears to be increased in areas of the brain associated with attentional focus, sensory processing, and reflective awareness of sensory experience.<sup>3</sup> Gray matter density is increased in brain regions associated with learning, memory, emotional regulation, and self awareness.<sup>4</sup>

Multiple studies have shown measurable physiologic effects, including increased natural killer cell function, enhanced antibody response, reduction in inflammatory cytokine levels, increased heart rate variability, and reductions in serum cortisol levels. However, the precise mechanisms by which mindfulness meditation may result in improvement in various medical and psychiatric conditions remains unclear. In fact, this is true of all mind-body techniques including relaxation exercises, breath work, guided imagery, journaling, and self-hypnosis. Hypotheses include a reduction in severity of physical symptoms, increased levels of psychological acceptance of various physical and emotional experiences, increased ability to cope, and reductions in the stress response to disease and symptoms.

Richard Davidson, Director of the Center for Investigating Healthy Minds at the University of Wisconsin and board member of the Mind and Life Institute, has contributed substantial insight into the neurophysiology of the brain as well as the effects of mental training, with his highly publicized research on the exceptional mental abilities of advanced Tibetan monks. Perlman et al recently compared a focused attention meditation technique to a mindfulness technique in long-term meditators proficient in both approaches, while exposing the subjects to noxious stimuli. Responses were compared to a control group of novice meditators using each technique. The mindfulness meditation technique resulted in a reduction of self-reported unpleasantness, though not intensity, of the noxious stimuli in the long-term meditators compared to novices. The focused attention meditation technique resulted in no differences between novice and long-term

meditators in reported unpleasantness or intensity of the noxious stimuli.<sup>5</sup>

### Clinical Applications

**Pain.** Medical research into mindfulness training initially focused on pain, stress, coping, and quality of life. In 1982, Kabat-Zinn reported reduction in perceived pain of at least 50% in half of chronic pain patients who completed MBSR compared to a control group of patients receiving usual care in a pain clinic.<sup>6</sup> In a small (n = 25) randomized controlled trial, Esmer et al found improvements in pain acceptance, pain intensity, quality of life, and a reduction in functional limitation in patients with failed back surgery syndrome.<sup>7</sup> Grossman et al noted significant improvement in pain and quality of life in a quasi-randomized controlled study of 58 patients with fibromyalgia who completed MBSR training, and improvements were sustained in a subgroup of 26 participants at 3-year follow up. However, in a larger, similarly structured study by the same researchers that was carefully randomized and included an active treatment control group, these improvements were not confirmed.<sup>8,9</sup>

**Anxiety and Depression.** Kabat-Zinn published descriptive data from long-term (3-year) follow up on a small (n = 18) cohort of patients with anxiety that completed MBSR. He found that they reported significant and sustained reductions in depression and anxiety, and a reduction in number and severity of panic attacks compared to pretraining baseline levels. Ten out of these 18 subjects also reported that they continued to practice a formal mindfulness technique at 3 years.<sup>10</sup> A more recent randomized study with a wait list control group showed small to moderate improvement in 30 people with anxiety disorders immediately after MBSR training and at 6-month follow-up.<sup>11</sup> Schizophrenia, active psychosis, and suicidality have been considered contraindications to participation in MBSR. There has been a particular concern about exacerbation of psychotic symptoms during meditation practice. However, a recent small study of 15 schizophrenic patients taking mindfulness training for anxiety symptoms showed no evidence of psychotic symptoms emerging during meditation practice.<sup>12</sup> MBSR was shown by Sephton et al to alleviate depressive symptoms in women with fibromyalgia compared to a wait list control group.<sup>13</sup> A meta-analysis of research on the effects of MBSR on the mental health of patients with chronic medical disease concluded that MBSR has small positive effects on depression, anxiety, and psychological distress.<sup>14</sup>

**Cancer.** MBSR has been investigated as a way to address psychological comorbidities in cancer survivors. A 2009 meta-analysis of 10 randomized controlled trials and observational studies concluded that MBSR may im-

prove cancer patients' psychological adjustment to their disease.<sup>15</sup> A 2011 literature review of MBSR studies in breast cancer survivor cohorts found moderate to large effect sizes on anxiety, stress, and mood disturbance.<sup>16</sup>

**Other Applications.** In a variety of controlled and observational studies, MBSR has been shown to improve response to PUVA treatment in psoriasis patients;<sup>17</sup> to reduce the degree of bother and distress in women due to hot flashes;<sup>18</sup> to improve glycosylated hemoglobin and blood pressure in patients with type 2 diabetes;<sup>19</sup> to buffer CD4+T lymphocyte declines in HIV infected patients;<sup>20</sup> and to improve quality of life in patients with traumatic brain injury.<sup>21</sup> Drawing conclusions and making recommendations based on these isolated studies with small to moderate apparent effect sizes is not prudent. However, the results continue to support hypotheses that MBSR may have wide therapeutic applications. A systematic review of research on mindfulness meditation for substance abuse disorders reported that the intervention might be useful but no firm conclusions about its effectiveness could be made.<sup>22</sup> A Cochrane analysis of the limited research on the use of meditation therapies for treatment of ADHD concluded that there is presently insufficient evidence of efficacy.<sup>23</sup>

Mindfulness training has been shown repeatedly in non-medical populations to improve measures of perceived stress, positive mood and affect, quality of life, and mindfulness.<sup>24</sup>

These effects of MBSR would suggest that medical students and physicians would benefit from mindfulness training and practice as a way of mitigating the stress of professional training and work. Groopman suggests that medical error is often the result of faulty thinking and cognitive traps, such as anchoring (snap judgments and premature closure), and attribution errors (stereotyping). He further proposes that paying attention to the process of thinking, a clearly mindful metacognitive practice, would help a physician to avoid these kinds of errors.<sup>25</sup> To date, few studies have been done on medical students and physicians to assess the effects of mindfulness training. Rosenzweig et al reported a significant effect of MBSR training on total mood disturbance in second-year medical students in a prospective, non-randomized study that had an active cohort control group.<sup>26</sup> Recently, Zeidan et al found that brief mindfulness training improved visuospatial processing, working memory, and executive functioning, suggesting other ways that physicians and medical students might benefit from MBSR.<sup>27</sup>

### Recommendations

Though the field of mindfulness research is presently quite prolific (more than 350 research publications in 2010 alone), most of the research to date on mindfulness

training as a medical intervention has been limited by a variety of methodological flaws. Many studies involve small sample sizes. Interventions labeled as mindfulness meditation can vary widely in format. For the MBSR course per se, which is a fairly standardized and structured intervention, there still may be wide variations in group experience based on instructor protocol adherence and participant skill acquisition during the sessions. The MBSR pre-course interview that illuminates expectations and the commitment necessary to complete the program often results in a cohort of patients who, though initially interested, fail to enroll or fail to show up for the first and subsequent sessions. Adherence has been cited as a problem in literature reviews and meta-analyses. Intention-to-treat analysis is lacking in many studies. Though some studies have included wait list control groups, helping to control for regression toward the mean, few have had active control groups to help assess for non-specific group effects of treatment. Many studies fail to discern between participants in the course who are compliant and non-compliant with the daily home practice or those who continue to practice after the course is completed. Information on long-term maintenance of measured improvements is lacking. In some studies, patients have been enrolled after referral by their personal physician or after reading a program brochure, thus, introducing bias through significant positive endorsement of the program. Consensus about working definitions of mindfulness is lacking in research, hindering interpretation of results both in basic science and clinical studies. More high-quality neurobiological and clinical research is needed to address the limitations in current studies before firm conclusions can be drawn about MBSR as an effective clinical intervention. The National Institutes of Health is presently supporting research on the use of mindfulness training for the management of irritable bowel syndrome, inflammatory bowel disease, diabetes, HIV and AIDS, respiratory infection, and mental health disorders.

MBSR research has shown no adverse effects to date. However, there is often a cost for the program that may be prohibitive for some patients. The course requires a significant time commitment. It is possible that patients participating in MBSR might postpone other appropriate treatments for their problems and that MBSR might not provide them with any benefits upon course completion. Nonetheless, the evidence suggests that MBSR may be helpful in improving stress symptoms, increasing ability to cope with pain and chronic illness, improving quality of life, and improving mental health both in sick and well individuals. Despite the limitations of existing research, it is a low-risk intervention. The implied benefits from existing clinical studies and evolving neurobiological research on mindfulness inform us that MBSR can be safely recommended and endorsed for motivated and interested

patients, both for self care and as an adjunct therapy for many physical and psychological problems. ■

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## CME Questions

### 21. Which of the following is not associated with yoga?

- a. Relaxation training and techniques
- b. Breathing techniques
- c. Calorie-restricted diet
- d. Physical postures

### 22. Senobi breathing is similar to pranayama, and involves stretching the arms above the head and arching the back.

- a. True
- b. False

### 23. Which of the following is true regarding the mechanism of action of vitamin D and dementia?

- a. Vitamin D may protect the brain directly by decreased oxidation and inflammation and improvement in neuron health.
- b. Vitamin D may protect the brain indirectly via decreased peripheral artery disease and cerebrovascular and cardiovascular disease.
- c. Vitamin D may be neuroprotective by inhibiting nitric oxide synthase and upregulating enzymes involved in glutathione synthesis.
- d. All of the above

### 24. What is the primary focus of mindfulness based stress reduction?

- a. Meditation practice for physiologic relaxation
- b. Cultivating an increased awareness of physical, mental, and emotional experiences without associated value judgments or interpretation.
- c. Incorporating pranayama breathing techniques into daily practice.
- d. All of the above

Answers: 21. c, 22. a, 23. d, 24. b.

## CME Instructions

Physicians participate in this continuing medical education program by reading the articles, using the provided references for further research, and studying the CME questions. Participants should select what they believe to be the correct answers, then refer to the list of correct answers to test their knowledge. To clarify confusion surrounding any questions answered incorrectly, please consult the source material.

After completing this activity, participants must complete the evaluation form provided at the end of each semester (June and December) and return it in the reply envelope provided to receive a credit letter. When an evaluation form is received, a credit letter will be mailed to the participant.

## CME Objectives

After completing the program, physicians will be able to:

- a. present evidence-based clinical analyses of commonly used alternative therapies;
- b. make informed, evidence-based recommendations to clinicians about whether to consider using such therapies in practice; and
- c. describe and critique the objectives, methods, results and conclusions of useful, current, peer-reviewed clinical studies in alternative medicine as published in the scientific literature.

## In Future Issues:

## Melatonin and Menopause Supplements for Erectile Dysfunction

# Alternative Medicine Alert

## 2011 Reader Survey

In an effort to learn more about the professionals who read *AMA*, we are conducting this reader survey. The results will be used to enhance the content and format of *AMA*.

Instructions: Fill in the appropriate answers. Please write in answers to the open-ended questions in the space provided. Return the questionnaire in the enclosed postage-paid envelope by July 1, 2011.

1. Are the articles in *Alternative Medicine Alert* written about issues of importance to you?

- A. Always
- B. Most of the time
- C. Some of the time
- D. Rarely
- E. Never

In future issues of *AMA*, would you like to see more or less coverage of the following topics?

A. more coverage B. less coverage C. about the same amount

- |                                     |                         |                         |                         |
|-------------------------------------|-------------------------|-------------------------|-------------------------|
| 2. Acupuncture                      | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C |
| 3. Biofeedback                      | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C |
| 4. Chiropractic                     | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C |
| 5. Dietary supplements              | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C |
| 6. Energy medicine                  | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C |
| 7. Exercise                         | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C |
| 8. Herbal therapies                 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C |
| 9. Massage therapy                  | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C |
| 10. Meditation                      | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C |
| 11. Nutrition                       | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C |
| 12. Vitamins, minerals, amino acids | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C |
| 13. Yoga/tai chi                    | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C |

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A. excellent B. good C. fair D. poor

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- D. Nursing degree
- E. Other \_\_\_\_\_

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- A. None
- B. 1
- C. 2
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27. To which other publications or information sources about complementary medicine do you subscribe?

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28. Which publication or information source do you find most useful, and why? \_\_\_\_\_

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29. Please list the top three challenges you face in your job today.

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30. What do you like most about *AMA* newsletter?

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32. What issues would you like to see addressed in *AMA* newsletter?

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33. Has reading *Alternative Medicine Alert* changed your clinical practice? If yes, how? \_\_\_\_\_

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