Lower Lipid Peroxide Levels in Practitioners of the Transcendental Meditation® Program

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Objective: Oxidative stress or free radical activity may contribute to the pathophysiology of atherosclerosis and other chronic diseases associated with aging. Because psychosocial stress has been shown to increase oxidative stress, we conducted an exploratory study to investigate the effects of stress reduction with the Transcendental Meditation (TM) program on serum lipid peroxide levels in elderly subjects. *Method:* Forty-one normally healthy subjects (aged 56 to 74 years, average 67 years) were recruited from the same Midwest city. Eighteen were long-term practitioners of the TM program (average 16.5 years.). Twenty-three controls were not practicing a formal stress management technique. Venous blood samples were analyzed for lipid peroxides by the TBARS assay. A dietary questionnaire was used to assess fat intake, red meat consumption, antioxidant vitamin supplementation, and smoking. Differences between groups and subgroups were analyzed by *t* test, and correlations. *Results:* Significantly lower serum levels of lipid peroxides were found in the TM practitioners compared with controls (−15%, $p = .026$). No significant differences were found between groups on smoking, fat intake, or vitamin supplementation. TM practitioners also had lower red meat consumption but matched subgroup analysis and partial correlations did not confirm a relationship between red meat intake and lipid peroxide levels. *Conclusions:* These preliminary findings suggest that lower serum lipid peroxide levels may be associated with stress reduction using the Transcendental Meditation technique. Prospective controlled trials are needed to confirm that this effect is because of TM practice rather than other lifestyle factors, such as diet. **Key words:** Lipid peroxides, oxidative stress, Transcendental Meditation.

INTRODUCTION

The hypotheses that free radical-mediated oxidation (ie, oxidative stress) may contribute to the pathophysiology of atherosclerosis, coronary heart disease (CHD), other chronic diseases (eg, cancer and rheumatoid arthritis), and the aging process have gained increased acceptance (1, 2–5). There is a growing body of evidence that oxidized lipids may be an important initiating factor in atherosclerosis (6–9) and are positively associated with advanced age (6). Furthermore, chronic psychosocial stress may increase oxidative stress (10–12). Thus, psychosocial stress may contribute to the etiology of CHD, other chronic diseases, and aging through free radical mechanisms.

Stress reduction with the Transcendental Meditation (TM) program has been shown to decrease psychosocial stress (13–15). Epidemiological data (15, 16) and controlled clinical trials (17–20) have suggested that lower rates of CHD morbidity and mortality are associated with long-term practice of TM in older subjects. In addition, rates of other free-radical related conditions, such as cancer and aging, have also been reported lower in TM practitioners (15, 16, 21, 22). However, to date, the effects of stress reduction with TM practice on oxidative stress have not been investigated. Therefore, we conducted an initial exploratory study to evaluate serum lipid peroxide levels in older practitioners of the TM program compared with controls.

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Presented in part at the Third International Congress of Behavioral Medicine, Amsterdam, the Netherlands, July 6–9, 1994.

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Received for publication August 8, 1995; revision received January 15, 1997.

METHODS

Study Group

The 41 subjects were normally healthy, community-dwelling residents from the same geographical area of Southeastern Iowa. The ages ranged from 56 to 74 years with a mean age of 67 years. All subjects volunteered to participate in the study and gave written informed consent. The experimental group included 18 subjects (12 women and 6 men) who had practiced the Transcendental Meditation program for an average of 16.5 years. The control group included 23 subjects (14 women and 9 men) who did not practice any formal stress management technique and were similar to the experimental group in age, gender distribution, and education level (see Table 1).

Procedures

Blood samples were drawn by venipuncture and the serum analyzed for lipid peroxides by spectrophotometric detection of the adduct formed by the reaction of thiobarbituric acid (TBA) with malondialdehyde (MDA) (23). The TBA assay has been widely used to measure blood levels of lipid peroxides. The sensitivity of the reaction is high but the specificity has been questioned (24). However, despite these methodological concerns, higher levels of MDA (produced from lipoperoxides in the heating reaction) have been demonstrated in patients with atherosclerotic diseases compared with healthy controls (11, 25). Using a modified Slaters method, developed to enhance specificity, Naito et al. (6) found that serum thiobarbituric reactive substances (TBARS) values consistently increased with age and were higher in patients with atherosclerosis.

A standardized risk-factor profile questionnaire was used to assess possible confounding factors (26). This diet and lifestyle questionnaire included items on fat intake, vitamin intake, smoking, and meat intake. Dietary fat intake was assessed by asking subjects, "How many servings of high fat foods do you eat per day?" (eg, meat, cheese, fried foods, ice cream, and other fatty foods). The four choices were: a) less than one serving, b) one to three, c) four to six, d) greater than six. To investigate vitamin intake, subjects were asked whether they were taking vitamins—A, C, E, β-carotene, or others. Cigarette smoking was determined by asking subjects whether they smoke and, if so, how many packs per day? To assess red meat consumption, subjects were asked, "How much red meat do you consume daily?" Choice responses were 0 = none, 1 = little, 2 = average, 3 = a lot.

Statistical Analysis

Mean differences between the treatment groups on demographics, dietary factors, and lipid peroxide levels were assessed by *t* tests (see Table 1). χ^2 analysis of dichotomous variables yielded similar

0033-3174/98/6001-0038$03.00/0

TABLE 1. Baseline Characteristics

	Experimental (N = 18)	Control (N = 23)	p Value
Demographics			
Age (yr)	67.8 ± 4.6	66.9 ± 4.8	0.55
Sex (% male)	44	50	0.34
Education level (% with college degrees)	67	61	0.23
Dietary[a] and lifestyle factors			
Dietary fat intake[b]	1.6	1.7	0.64
% Taking vitamin supplements[c]	56	78	0.23
Red meat consumption[d]	0.50 ± 0.52	1.41 ± 0.51	0.0003
% Smoking	6.3	5.9	0.97
Outcome variable			
Lipid peroxides (nmol/ml)	2.07 ± 0.41	2.43 ± 0.47	0.026

[a] See Methods for explanation of scales for dietary variables.
[b] Average number of servings of high fat foods per day.
[c] Values represent percentage of subjects reporting taking either multivitamins or monovitamins A, C, E or β-carotene.
[d] Values represent average daily consumption of red meat.

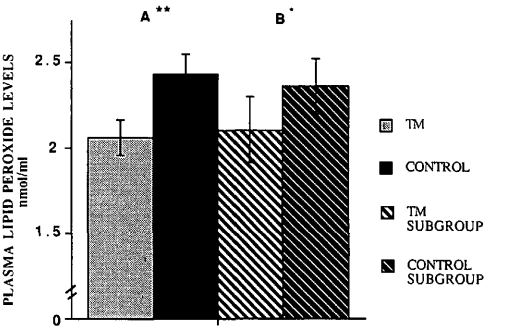

Fig. 1. Lipid peroxide levels in older practitioners of (A) TM program (N = 18) vs. control (N = 23) groups and (B) TM program (N = 8) vs. control (N = 10) subgroups who are matched on red meat consumption. ** p = .026; *p = .32.

outcomes. To investigate the interrelationships between treatment status, diet, and lipid peroxides, Pearson product-moment correlations and partial correlations were performed. All tests were two-tailed.

RESULTS

There were no significant differences between the experimental and control groups in age, gender distribution, or education (Table 1). No significant difference in dietary factors was found between the two groups on: a) fat intake; b) vitamin supplementation, or c) smoking. However, the TM practitioners consumed less red meat than the control group (p = .0003). The mean response was between "none" and "little" red meat (0.5) for the TM group vs. more than "little" (1.4) consumption for the control group (Table 1). The Transcendental Meditation group showed a significantly lower level of lipid peroxide concentration (2.067 nmol/ml ± 0.408 SD) compared with the control group (2.431 ± .466 SD), t = 2.272. p = .026) (Figure 1)

Because red meat consumption differed between the two treatment groups, additional analyses were performed to evaluate the contribution of red meat intake to the main results. First, the experimental subjects (N = 8) and control subjects (N = 10) who were matched for red meat intake levels were compared. The difference between the subgroups on lipid peroxides (TM group, 2.11 vs. control group, 2.363 nmol/ml; p = 0.32) (Figure 1) did not reach significance but was of similar magnitude to the difference between groups in the primary analysis and was associated with a medium effect size of 0.49 (27). With a power of .80, an effect size of this magnitude would require 24 subjects in each subgroup (27) to attain statistical significance. Second, although the correlation between red meat intake and lipid peroxides was significant (r = .36, p = .043), partial correlation controlling for treatment status did not demonstrate a significant correlation between lipid peroxides and red meat intake (r = .14, p = .25)

DISCUSSION

In this preliminary study, lower levels of plasma lipid peroxides were found in older long-term practitioners of the Transcendental Meditation program compared with control subjects of similar age, gender, level of education, and place of residence. These findings suggest the hypotheses that: a) lower lipid peroxide levels may be associated with practice of the TM technique and b) the reported stress reduction effect of TM practice may contribute to the lower oxidative stress. The 15% lower plasma lipid peroxide levels in the TM group compared with healthy controls would seem to be of clinical significance. For example, in an epidemiological study that assessed lipid peroxides in a similar manner, healthy subjects (N = 736) had a 9% lower lipid peroxide level than patients with coronary heart disease (28).

Growing evidence indicates a relationship between psychosocial stress and free radical activity (10–12). The underlying mechanism of how stress reduction through the TM technique may be associated with lipid peroxides is not yet clearly understood. One possible explanation may be lower sympathetic nervous system activity in TM practitioners (14, 29–31). Increased catecholamines during psychosocial stress have been shown to stimulate prostaglandin synthesis (32) which is positively correlated with lipid peroxides (33, 34).

Another possible mechanism underlying the proposed oxidative stress reduction effect of TM practice may be an increase in the hormone, dehydroepiandrosterone sulfate (DHEAS), a biochemical marker of aging that has been shown to enhance antioxidant enzyme systems (35) and to have antiatherosclerotic effects (36, 37). DHEAS has been found in controlled prospective and cross-sectional studies to be significantly higher in TM program practitioners compared with nonmeditating controls across nearly all age groups and both sexes (38–40).

We investigated several other dietary and lifestyle factors that could have confounded the lipid peroxide results. With respect to dietary fat intake and vitamin supplementation, no significant differences were found between the TM group and the control group, although it is possible that the significant difference in lipid peroxide levels could have been related to differences in dietary choices which were not assessed in this study. It has been recently found in epidemiological studies that fresh fruits and vegetables high in antioxidants, particularly vitamins C and E, have been correlated with higher

plasma levels of antioxidant vitamins as well as lower plasma lipid peroxide levels (41, 42). Epidemiological studies have also found that persons who consume larger quantities of these food groups have a substantially lower risk of cancer and heart disease (41, 43). This study did not assess these or other possible dietary variables that may be important and, therefore, should be evaluated in future studies.

An alternative hypothesis was that lower red meat consumption in the TM group could have contributed to lower lipid peroxide levels. However, when matched on red meat intake, the mean differences in lipid peroxides between TM and control subgroups was similar to the differences found in the primary analysis of overall groups and was associated with a medium effect size (0.49). This would have reached conventional statistical significance if there were 24 subjects in each subgroup. Moreover, the modest but significant correlation between red meat intake and lipid peroxide levels in the whole sample was no longer significant after adjusting for the association with treatment status. This suggests that lipid peroxide levels in this sample were associated with treatment group rather than with diet in this study.

Future studies should use a more comprehensive dietary assessment that a) more precisely quantifies intake levels in order to reduce ambiguous "subjective" responses (eg, fat intake), b) assesses specific food groups that may be high in antioxidants (ie, fruits, vegetables, etc), and c) evaluates additional dietary supplements not monitored in the present study. Also, to additionally assess the causal relationship between TM practice and lipid peroxides, a randomized controlled trial should be performed in which the groups are initially stratified on dietary and lifestyle factors including red meat and lipid peroxide levels measured before and after active intervention.

In conclusion, the findings of this exploratory study suggest that lower plasma levels of lipid peroxides in a community-dwelling sample of matched older adults are associated with practice of the TM technique. If confirmed, this may provide a mechanism for reduced incidence of coronary heart disease and improvements in other age-related parameters previously reported in TM practitioners (15–22) in addition to previously suggested mechanisms (44–45).

The authors would like to thank Gloria Foster and Rachel Goodman for their invaluable assistance in recruitment and data collection, and Maxwell Rainforth for his helpful input on the statistical analysis.

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