Lowering Cortisol and CVD Risk in Postmenopausal Women

A Pilot Study Using the Transcendental Meditation Program

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ABSTRACT: Unlike younger women, the risk of cardiovascular disease in older women matches or exceeds that of men. Excessive cortisol may play a role in this increased risk. Here we explore the possibility that the Transcendental Meditation (TM) program may reduce the cortisol response to a metabolic stressor as a way of reducing disease risk in older women. Data from 16 women who were long-term practitioners of transcendental meditation (mean = 23 y) were compared with data from 14 control women matched for age (mean = 75 y, range = 65-92 y). Data on demographics, disease symptoms, and psychological variables were collected, and cortisol response to a metabolic stressor (75 g of glucose, orally) was examined in saliva and urine. Pre-glucose levels of salivary cortisol were identical for the two groups. Post-glucose cortisol rose faster in the controls and was significantly higher than that in the TM women (P < 1 × 10⁻⁴). Urinary excretion of cortisol during this period was 3 times higher in controls than in the TM women (2.4 ± 0.17 and 0.83 ± 0.10 µg/h, respectively; P = 2 × 10⁻⁴). In addition, the number of months practicing transcendental meditation was inversely correlated with CVD risk factors. Lower cortisol response to metabolic challenge may reflect improved endocrine regulation relevant to the disease-preventing effects of transcendental meditation in older women.

KEYWORDS: cortisol; cardiovascular disease; menopause; meditation; metabolic syndrome

INTRODUCTION

Cardiovascular disease (CVD) is primarily a disease of the elderly. In the United States, by age 65, CVD is the major cause of death in women as it is in men.¹ ² In
women, the large increase in CVD risk that occurs during and after menopause is not entirely due to declines of sex hormones, because hormone replacement therapy does not remove CVD risk; in some cases it only adds to it.\textsuperscript{3,4}

A more likely candidate for increased postmenopausal risk for CVD and CVD-related mortality is increased stress or increased stress responsiveness.\textsuperscript{5–10} Increased stress responsiveness after menopause has been observed in both cardiovascular and neuroendocrine systems.\textsuperscript{9,11–13} Such stress-related alterations appear to be relevant to the observed differences in hemodynamics, left ventricular structure, and nighttime blood pressure dipping between pre- and postmenopausal women.\textsuperscript{14,15} Evidence for a deleterious influence of menopause on fat metabolism also exists.\textsuperscript{16–18} Increased visceral fat is particularly strongly associated with chronic stress, CVD, and risk factors for CVD, including the cluster of risk factors identified as the “metabolic syndrome,”\textsuperscript{19,20} including three or more of the following: hyperinsulinemia, hyperglycemia, abdominal obesity, hypertension, and hyperlipidemia.

Excessive levels of the stress-induced hormone cortisol may play a role in this increased susceptibility to CVD in older women, and some natural medicine approaches may prevent or reverse this chronic increase of cortisol (see Ref. 21 for a review). To explore the possibility that such approaches can reduce cortisol response to stress, we cross-sectionally examined the long-term effects of the Transcendental Meditation program, a component of the traditional system of health care known as Maharishi Consciousness-Based Health Care, previously reported to reduce stress, cortisol, and CVD risk.\textsuperscript{21}

**METHODS**

Data from 16 women (mean age 75 y) who had practiced the Transcendental Meditation program long-term (mean 23 y) were compared with data from 14 control women, matched for age, who had practiced no systematic program for stress reduction. For comparison, male subjects of the same age (10 Transcendental Meditation subjects and 11 controls) were also studied. Data on demographics, disease symptoms, and psychological variables were collected, and cortisol response to a metabolic stressor (75 g of glucose administered orally) was examined in saliva and urine. Cortisol was analyzed by radioimmunoassay (Diagnostic Products Corp., Los Angeles, CA) as previously published,\textsuperscript{22} with a coefficient of variation of 3.6%. Other measures used standardized test instruments and procedures.

The testing procedure was as follows. Subjects began arriving at 10:30 AM and were asked to urinate in the toilet to empty their bladders. They recorded this time as the starting time for urine collections. Between this time and the end of testing (3 PM), all urine generated was collected in a single bottle for each subject, with the last timed urination occurring as close to 3 PM as possible. At 11 AM, all subjects began salivary collections and filled out questionnaires. Urine and saliva samples were stored frozen until assay. At 12 noon, subjects consumed 75 g of glucose in water flavored with the juice of lemon or lime. Blood pressure measurements were conducted throughout the period, with each subject being measured three times at least 15 min apart.
RESULTS

The control and Transcendental Meditation groups of women were not significantly different on demographic and lifestyle variables (i.e., age, education, income, exercise level, smoking, alcohol consumption, and weight) or family history of disease (i.e., CVD, cancer, and allergies). However, Figure 1 shows that the response of salivary cortisol to the glucose bolus administered at 12 noon was significantly different for the two groups of women \((P = .0001, \text{repeated measures ANOVA})\), with the control group rising 7.5 times faster than the Transcendental Meditation group between the 12:15 and 12:30 PM time points. By contrast, for the men, the control group responded only weakly to glucose and was significantly less responsive than the Transcendental Meditation group (not shown). In the Transcendental Meditation subjects, the cortisol response to glucose was significant for the men and women’s groups and was of similar magnitude and duration in men and women.

In women, the group differences in urinary excretion of cortisol over the 4-h period were parallel to those in salivary cortisol. Control women had threefold greater cortisol excretion than did the Transcendental Meditation women \((2.4 \pm 0.17 \text{ and } 0.83 \pm 0.10 \mu g/h, \text{respectively; } P = 2 \times 10^{-4})\). The initial rate of glucose-induced rise in salivary cortisol, as shown by the difference between the 12:15 and 12:30 time points, correlated highly with urinary cortisol excretion across all women (Pearson correlation coefficient: \(r = .82; n = 29, P < 5 \times 10^{-4}\)). On the other hand, cortisol excretion rates in men appeared not to correlate with the relative increases in salivary cortisol. Control men had 1.5-fold greater urinary cortisol excretion than did Transcendental Meditation men \((1.89 \pm .30 \text{ vs. } 1.26 \pm .14 \mu g/h, \text{respectively; } P = .06)\) despite the higher salivary cortisol response to glucose in the Transcendental Meditation men than the control men.

Two other correlations were noteworthy. In the Transcendental Meditation group of women, the number of months practicing the technique correlated negatively with cortisol excretion \((r = -.63, P = .015)\). The number of months practicing the technique also correlated negatively with the number and severity of symptoms of heart disease, as determined by a nine-item questionnaire \((r = -.91; P = 6 \times 10^{-6})\).
DISCUSSION

These findings suggest that long-term practice of the Transcendental Meditation program reduces the response of the hypothalamic-pituitary-adrenocortical (HPA) axis to a bolus of glucose in postmenopausal women. Studies in younger subjects, both men and women, also support a normalizing effect of this program on the HPA axis.22–24 The present findings are the first to suggest that a meditation technique can reduce the effects of a metabolic stressor on the HPA axis. Because elevated cortisol may be a causal factor in producing the metabolic syndrome, the apparent ability of the Transcendental Meditation program to reduce cortisol response to a metabolic stressor may play a role in the preventive effects of this program on CVD and coronary disease.25

REFERENCES


