Nutrition and Aging

High Cognitive Dietary Restraint Is Associated With Increased Cortisol Excretion in Postmenopausal Women

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Background. Cognitive dietary restraint (perceived ongoing effort to limit dietary intake to manage body weight) is common in women at all life stages. In young women, high dietary restraint has been associated with both increased excretion of cortisol (a stress hormone) and reduced bone mass. Whether this occurs in older women is unknown and is reported here for the first time.

Methods. Postmenopausal women (49–75 years old) with high (n = 41) or low (n = 37) dietary restraint were compared to examine differences in urinary cortisol excretion, body composition assessed by dual-energy x-ray absorptiometry (bone mineral density, % body fat), dietary intake, anthropometrics, current exercise, and perceived stress.

Results. Women with high or low dietary restraint did not differ in age, body mass index, waist-to-hip ratio, energy intake, perceived stress, current exercise, or measures of body composition. However, urinary cortisol excretion was higher in the high restraint group (248.2 ± 61.7 nmol/d vs 204.3 ± 66.1 nmol/d; p = .01). Multiple regression analysis indicated that restraint group (high or low) independently predicted 7.6% of the variance in cortisol excretion.

Conclusions. Postmenopausal women with high dietary restraint excrete more cortisol than do those with low restraint, suggesting that dietary restraint may be a source of stress. Although this was not associated with negative health effects in this sample, further investigation is warranted.

For many women, eating is characterized by cognitive dietary restraint, the perception of constantly monitoring and attempting to limit dietary intake in an effort to achieve or maintain a certain body weight (1). This characteristic overlaps with, but is not analogous to, dieting (2). Although it may appear innocuous, dietary restraint could have detrimental health effects in normal-weight women. Specifically, the subjective experience of high dietary restraint may be a subtle but chronic psychological stressor (3), activating the hypothalamic–pituitary–adrenal (HPA) axis and leading to increased release of the stress hormone cortisol (4). Over time, elevated cortisol has detrimental effects on many body systems (5). With respect to bone, high cortisol has adverse effects on calcium and bone metabolism (6), and reduced bone mineral density (BMD) has been observed with high endogenous cortisol (7), pharmacological doses of glucocorticoids (8), and even elevated cortisol within the physiological range (9–12). Thus, if high cognitive dietary restraint contributes to increased cortisol secretion, bone health may suffer.

Studies of young women have supported this hypothesis by demonstrating associations between high dietary restraint and increased 24-hour urinary cortisol excretion (3), elevated morning salivary cortisol (13), and lower bone mineral content (BMC) (14–16). However, some reports (possibly lacking sufficient statistical power) have not detected associations between dietary restraint and cortisol (17,18).

Few studies exist of dietary restraint in postmenopausal women, perhaps because body weight and shape concerns are thought to be less prevalent in this age range. Yet it is possible that associations with cortisol and bone health could be most pertinent for this group, as some postmenopausal women may have experienced dietary restraint for many years, and low BMD is a clinical concern during this life stage. We therefore designed this study to determine whether postmenopausal women with high cognitive dietary restraint have higher cortisol excretion than do those with low dietary restraint. Secondary aims were to examine possible differences in body composition (BMD and % body fat) and dietary intake between groups.

METHODS

Participants

Seventy-eight postmenopausal women with high (n = 41) or low (n = 37) dietary restraint were recruited from respondents (n = 1071) initially recruited by newspaper advertisements to a survey of dietary attitudes and body image. The survey included the Three-Factor Eating Questionnaire (TFEQ) (1), a reliable and widely used measure of cognitive dietary restraint (19). The TFEQ cognitive restraint scale (TFEQ-R) assesses the perception of ongoing efforts to restrict dietary intake, independent of the tendency for this cognitive control over dietary intake to be disrupted. We thus chose it as a measure of dietary restraint rather than the Restraint Scale (20), which is confounded by disinhibited eating and weight fluctuation (19). In addition to the TFEQ, the preliminary questionnaire package asked “Are you currently trying to lose weight?” (yes or no) as a measure of...
dieting status (21) and “How many hours of exercise do you do each week?” as an estimate of habitual physical activity. It also prompted participants to record any medications that they were taking at that time.

To be eligible for the current study, a participant’s score for cognitive dietary restraint must have been either high (≥13) or low (≤6). These cutoff scores designated the highest and lowest quartiles of dietary restraint scores in our survey sample, and correspond to scores used previously to classify women with high or low dietary restraint (3,22,23). Other inclusion criteria were: age 45–75 years, ≥1 year since last menses, and body mass index (BMI) (based on self-reported height and weight) of 18.5–25.9 kg/m². Exclusion criteria were: use of drugs known to affect cortisol or bone metabolism; previous diagnosis of an endocrine disorder, osteoporosis, or an eating disorder; surgical menopause (including oophorectomy); or current hormone replacement therapy.

Of 1071 survey respondents, 1007 (94%) expressed an interest in participating in the current study. The most common reason for exclusion (n = 445) was a score for cognitive dietary restraint in the “medium” range (score 7–12, inclusive). An additional 190 women were excluded because their self-reported BMI was <18.5 (n = 19) or ≥25.9 (n = 171). A total of 149 women were invited to participate in this study and, after making further exclusions based on the criteria above, 78 enrolled. Power analysis estimated that 28 participants per group would be required to detect a significant difference in 24-hour urinary cortisol excretion (α = 0.05, β = 0.20). We over-recruited to allow for possible attrition and incomplete samples. The university’s Clinical Research Ethics Board approved the study protocol, and women provided written informed consent to participate.

Questionnaires

After study entry, participants completed another TFEQ with 14 additional questions to further measure the “rigid control” and “flexible control” dimensions of dietary restraint (24). All questions were reproduced and scored as suggested (1,24), except the first true/false TFEQ item, which was reworded, as done previously (25), to make it suitable for people who may not eat meat. Participants also completed the Perceived Stress Scale (26) to assess global perceived stress and the Nutrition Hassles Scale (27) to measure general nutrition-related stress and hassles. They answered a question about past use of hormone replacement therapy, and indicated how often they watched what they ate (two collections in total). The first urine void after awakening on the collection day was discarded and the time recorded. All urine passed in the subsequent 24 hours (including the next day’s first morning void) was collected and transferred to a collection bottle without preservative. Urine was kept cool throughout the collection period. Completed collections were transferred by courier to the laboratory for analysis. Participants recorded the start and finish times of each collection, and advised us if they had not collected all urine passed during that time. Complete collections were defined as 23–25 hours and included all voids. Urinary cortisol (nmol/d) was determined by competitive chemiluminescent immunoassay (Bayer ADVIA Centaur; Bayer HealthCare, Tarrytown, NY) and creatinine (mmol/d) was determined by a modification of the kinetic Jeffe reaction (29). Cortisol excretion during the 24-hour period was expressed both absolutely and as a ratio to creatinine.

Anthropometry and Body Composition

Height (cm) without shoes at full inspiration was measured to the nearest 0.1 cm using a stadiometer (model 214; seca, Hamburg, Germany). Weight (kg) was measured in light indoor clothing without shoes to the nearest 0.5 kg using an electronic scale (Sunbeam Inc., Boca Raton, FL). Waist and hip circumference were measured using an inflexible measuring tape (30). All measurements were made in triplicate and averaged. BMI and waist-to-hip ratio were calculated.

Body composition, including total body BMD and % body fat, was measured using dual-energy x-ray absorptiometry (DXA; Lunar Prodigy, enCORE software; GE Healthcare, Madison, WI). Additional BMD measurements were taken at the lumbar spine (L1–L4) and at both hips. Because confounding effects of vertebral collapse and other structural abnormalities affect 29%–40% of lumbar spine BMD measurements in postmenopausal women (artificially inflating BMD values) (31,32), we excluded vertebrae with T-scores that were either >1 unit higher than adjacent vertebrae or >0.6 unit higher than the mean L1–L4 T-score (32).

Statistical Analysis

Study variables were examined for normality prior to analyses, and statistics were computed using untransformed data. Missing values were excluded on a pair-wise basis. Univariate group differences (high vs low restraint) were compared using two-tailed independent-samples t tests or chi square. Associations between continuous variables were examined using Pearson correlation coefficients or Spearman’s rho. We used multivariate analysis of covariance (MANCOVA), with weight loss effort (yes or no) as a covariate, to examine differences in 24-hour urine variables for all participants providing at least one complete urine collection (n = 74). For these analyses, the mean of both...
Table 1. Descriptive and Anthropometric Characteristics of Postmenopausal Women with High or Low Cognitive Dietary Restraint

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>High Restraint (N = 41)</th>
<th>Low Restraint (N = 37)</th>
<th>p for Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td>59.1 ± 5.4</td>
<td>58.4 ± 4.9</td>
<td>.60</td>
</tr>
<tr>
<td>Menopausal age, y</td>
<td>7.1 ± 5.6</td>
<td>7.5 ± 5.2</td>
<td>.72</td>
</tr>
<tr>
<td>Height, cm</td>
<td>162.6 ± 7.3</td>
<td>163.9 ± 7.5</td>
<td>.44</td>
</tr>
<tr>
<td>Weight, kg</td>
<td>60.6 ± 6.8</td>
<td>62.1 ± 6.4</td>
<td>.33</td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td>22.9 ± 2.0</td>
<td>23.1 ± 2.3</td>
<td>.64</td>
</tr>
<tr>
<td>Waist circumference, cm</td>
<td>77.4 ± 5.5</td>
<td>78.3 ± 7.2</td>
<td>.52</td>
</tr>
<tr>
<td>Hip circumference, cm</td>
<td>98.3 ± 5.5</td>
<td>100.3 ± 5.7</td>
<td>.13</td>
</tr>
<tr>
<td>Waist-to-hip ratio</td>
<td>0.79 ± 0.05</td>
<td>0.78 ± 0.06</td>
<td>.57</td>
</tr>
<tr>
<td>Current exercise, h/wk</td>
<td>4.9 ± 3.1</td>
<td>4.1 ± 3.2</td>
<td>.25</td>
</tr>
</tbody>
</table>

Ethnicity

- No. (%) Caucasian: 33 (80.5) vs 31 (83.8), .84
- No. (%) Asian: 5 (12.2) vs 3 (8.1), .43
- No. (%) Other: 3 (7.3) vs 3 (8.1), .84

No. (%) Reporting

- Irregular menstrual cycles prior to menopause: 8 (19.5) vs 6 (16.2), .71
- Past hormone replacement therapy use: 8 (19.5) vs 14 (37.8), .07
- No. (%) Reporting use of diuretic medication: 1 (2.4) vs 0 (0), .34
- No. (%) Reporting use of antihypertensive medication: 3 (7.3) vs 1 (2.7), .36
- No. (%) Trying to lose weight: 19 (46.3) vs 8 (21.6), .03

Notes: Data presented as mean ± standard deviation or N (proportion). Group differences compared with two-tailed independent-samples t tests or chi square.

BMI = body mass index.

collections was used for participants with two complete collections (n = 46), whereas for participants with only one complete collection (n = 28), those values were used. Comparison of key variables between participants who provided one or two complete collections revealed no significant differences. We also conducted secondary analyses of urine data using: (i) mean values from participants providing two complete 24-hour collections (n = 46), (ii) data from all complete collections at time 1 (n = 64), and (iii) data from all complete collections at time 2 (n = 56). Stepwise multiple linear regression analysis was performed to examine predictors of urinary cortisol excretion. Interactions between restraint group (high or low) and weight loss effort (yes or no) were examined using two-way ANOVA for both energy intake and total cortisol excretion. We examined differences in body composition (% body fat, BMD) using univariate analyses of covariance (ANCOVA), with weight loss effort as a covariate. Statistical analyses were performed using the Statistical Package for the Social Sciences (version 11.5; SPSS Inc., Chicago, IL).

RESULTS

Seventy-eight women enrolled in the study, and all but one completed the entire protocol (98.7% retention rate). There were no significant differences between high (n = 41) and low (n = 37) restraint groups in age; years since menopause (menopausal age); anthropometrics; current exercise; ethnicity; or proportions reporting menstrual irregularity before menopause, past use of hormone replacement therapy, or use of diuretic or antihypertensive medications (Table 1). However, a greater proportion of women in the high restraint group had indicated that they were trying to lose weight.

Dietary Attitudes and Indices of Stress

Participants’ cognitive dietary restraint scores were consistent between assessments prior to recruitment and upon enrollment 4.1 ± 1.9 months later, with a test–retest value of 0.91 (p < .0001). Women in the high restraint group had higher scores for rigid and flexible control of eating than did women in the low restraint group; however, scores for overall perceived stress, daily stress for both 24-hour urine collections, and general nutrition-related stress were similar (Table 2). Cognitive dietary restraint was the only dietary or stress variable that correlated significantly with urinary cortisol excretion (Table 2).

Past Efforts to Control Eating

A greater proportion of high restraint women indicated they “usually” or “always” watched what they ate to control their weight during their teens (33% vs 8%, X² = 6.7, p = .01), their 30s (44% vs 8%, X² = 12.7, p < .0001), their 40s (56% vs 8%, X² = 20.2, p < .0001), their 50s (73% vs 11%, X² = 29.1, p < .0001), and their 60s (79% vs 14%, X² = 11.6, p = .001). The difference during the 20s was not significant (28% vs 16%, X² = 1.4, p = .23), and differences during the 70s could not be examined because only two participants were aged ≥70 years.

Dietary Intake

The high and low restraint groups had similar intakes of energy, carbohydrate, fat, alcohol, mean total water, fiber, calcium, vitamin D, caffeine, and sodium (Table 3). However, women with high dietary restraint tended to

Table 2. Comparison of High and Low Restraint Groups on Scores for Dietary Attitudes and Stress, and Correlations Between Those Scores and Cortisol Excretion

<table>
<thead>
<tr>
<th>Measure</th>
<th>High Restraint</th>
<th>Low Restraint</th>
<th>p for Difference</th>
<th>Correlation With Cortisol Excretion*</th>
<th>p for</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dietary restraint</td>
<td>15.5 ± 2.1</td>
<td>4.1 ± 2.3</td>
<td>&lt;.001</td>
<td>0.39</td>
<td>.001</td>
<td></td>
</tr>
<tr>
<td>Rigid</td>
<td>8.8 ± 2.3</td>
<td>3.7 ± 2.3</td>
<td>&lt;.001</td>
<td>0.18</td>
<td>.15</td>
<td></td>
</tr>
<tr>
<td>Flexible</td>
<td>4.7 ± 1.9</td>
<td>3.2 ± 2.1</td>
<td>.004</td>
<td>0.05</td>
<td>.68</td>
<td></td>
</tr>
<tr>
<td>Perceived stress</td>
<td>18.2 ± 8.1</td>
<td>21.4 ± 8.7</td>
<td>.11</td>
<td>0.02</td>
<td>.85</td>
<td></td>
</tr>
<tr>
<td>Daily stress</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 1</td>
<td>40.2 ± 35.2</td>
<td>37.9 ± 28.0</td>
<td>.79</td>
<td>0.02</td>
<td>.89</td>
<td></td>
</tr>
<tr>
<td>Time 2</td>
<td>33.0 ± 31.6</td>
<td>33.3 ± 35.6</td>
<td>.97</td>
<td>0.04</td>
<td>.76</td>
<td></td>
</tr>
<tr>
<td>Nutrition hassles</td>
<td>87.8 ± 43.1</td>
<td>80.2 ± 36.2</td>
<td>.41</td>
<td>−0.002</td>
<td>.99</td>
<td></td>
</tr>
</tbody>
</table>

Notes: Data presented as mean ± standard deviation. Missing values excluded pair-wise, thus exact n per group varied by comparison.

*Total cortisol (n = 74) used for all correlations except Daily Stress, for which cortisol excretion from complete collections at each time were used.


Table 3. Dietary Results From Two 3-Day Food Records for Postmenopausal Women With High or Low Cognitive Dietary Restraint

<table>
<thead>
<tr>
<th>Dietary Variable</th>
<th>High Restraint (N = 40)</th>
<th>Low Restraint (N = 36)</th>
<th>p for Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy, kcal</td>
<td>1880 ± 315</td>
<td>1921 ± 359</td>
<td>.85</td>
</tr>
<tr>
<td>Carbohydrate, g</td>
<td>238.1 ± 52.0</td>
<td>239.6 ± 57.1</td>
<td>.97</td>
</tr>
<tr>
<td>% kcal</td>
<td>49.6 ± 9.2</td>
<td>49.0 ± 8.1</td>
<td>.86</td>
</tr>
<tr>
<td>Protein, g</td>
<td>79.8 ± 19.0</td>
<td>72.1 ± 16.3</td>
<td>.18</td>
</tr>
<tr>
<td>% kcal</td>
<td>16.5 ± 3.0</td>
<td>14.7 ± 2.5</td>
<td>.02</td>
</tr>
<tr>
<td>Fat, g</td>
<td>67.8 ± 20.4</td>
<td>70.1 ± 18.9</td>
<td>.79</td>
</tr>
<tr>
<td>% kcal</td>
<td>31.3 ± 6.9</td>
<td>31.8 ± 5.5</td>
<td>.86</td>
</tr>
<tr>
<td>Alcohol, g</td>
<td>7.4 ± 9.7</td>
<td>13.1 ± 15.0</td>
<td>.12</td>
</tr>
<tr>
<td>% kcal</td>
<td>2.7 ± 3.5</td>
<td>4.5 ± 4.9</td>
<td>.16</td>
</tr>
<tr>
<td>Total water, g</td>
<td>2975 ± 877</td>
<td>2687 ± 814</td>
<td>.25</td>
</tr>
<tr>
<td>Fiber, g</td>
<td>27.2 ± 9.5</td>
<td>24.3 ± 8.8</td>
<td>.24</td>
</tr>
<tr>
<td>Calcium, mg</td>
<td>954 ± 314</td>
<td>865 ± 274</td>
<td>.24</td>
</tr>
<tr>
<td>Vitamin D, IU</td>
<td>155 ± 104</td>
<td>181 ± 97</td>
<td>.29</td>
</tr>
<tr>
<td>Sodium, mg</td>
<td>2460 ± 942</td>
<td>2276 ± 642</td>
<td>.42</td>
</tr>
<tr>
<td>Caffeine, mg</td>
<td>161 ± 141</td>
<td>181 ± 124</td>
<td>.69</td>
</tr>
<tr>
<td>No. (%) Using dietary supplements</td>
<td>38 (92.7)</td>
<td>24 (66.7)</td>
<td>.004</td>
</tr>
</tbody>
</table>

Note: Data presented as mean ± standard deviation or N (proportion). One participant in each group was excluded because she did not provide two complete 3-day food records. Group differences examined using multivariate analysis of covariance (MANCOVA) with weight loss effort (yes or no) as a covariate, and with chi square for proportion using supplements.

consume a greater proportion of energy as protein, and were more likely to take dietary supplements. A two-way ANOVA of energy intake by restraint group and weight loss effort (yes or no) revealed no main effects of restraint group ($F = 0.15, p = .70$) or weight loss effort ($F = 0.11, p = .74$), but a significant Reatina Group × Weight Loss Effort interaction ($F = 6.0, p = .02$). Within the high restraint group, women who reported trying to lose weight had higher energy intakes than did those not trying to lose weight ($1977 ± 292 vs 1800 ± 317$ kcal/d), whereas the converse occurred among women with low restraint ($1740 ± 566 vs 1793 ± 267$ kcal/d).

DISCUSSION

high dietary restraint may be a source of stress for generally healthy, normal-weight postmenopausal women. This stress appears to be psychological, rather than physiological, in nature. Restrained eaters in our study did not consume significantly less energy than those with low dietary restraint, thus energy deprivation does not seem a plausible stressor for these women. Furthermore, among women with high cognitive dietary restraint, cortisol excretion was positively associated with dietary restraint (Table 5). Two-way ANCOVA of cortisol excretion by restraint group and weight loss effort revealed a significant main effect of restraint group ($F = 11.3, p = .001$), no main effect of trying to lose weight ($F = 0.03, p = .87$), and a significant Restraint Group × Weight Loss Effort interaction ($F = 4.7, p = .03$). Women with high restraint who reported trying to lose weight had higher cortisol excretion than did those who were not ($268.4 ± 70.8 vs 230.9 ± 47.8$ nmol/d), whereas in the low restraint group, cortisol excretion tended to be lower in women who reported trying to lose weight ($179.3 ± 58.9 vs 211.7 ± 67.3$ nmol/d).

Stepwise multiple linear regression analysis was performed using variables significantly associated ($p < .05$) with cortisol excretion in univariate analyses (urine volume and mean intakes of total water, energy, protein, and fiber) and restraint group (high or low). Two variables predicted cortisol excretion: mean total water intake and dietary restraint group (Table 5).
restraint, those who reported trying to lose weight had both higher mean energy intakes and cortisol excretion than those not trying to lose weight, further arguing against an effect of energy deprivation on cortisol excretion. Parenthetically, this result emphasizes that the relationship between dietary restraint and “dieting” is not straightforward. Nevertheless, it seems reasonable that the ongoing effort to cognitively control dietary intake would be associated with a variety of mildly stressful thoughts and decisions about what and how much to eat, and that these could be exacerbated in restrained women trying to lose weight.

We suspect that this chronic low-level addition to the stress load of restrained eaters is responsible for the higher urinary cortisol excretion among postmenopausal women with high dietary restraint. When an individual experiences stress (physiological or psychological), there is increased activity in the HPA axis (4). Corticotropin releasing factor is synthesized in the paraventricular nucleus of the hypothalamus, thereby stimulating adrenocorticotropic hormone (ACTH) synthesis in the anterior pituitary. ACTH is released into the systemic circulation and causes the adrenal cortex to produce the steroid hormone cortisol and release it to the general circulation. This stress-associated increase in cortisol is superimposed on its normal circadian rhythm. Over time, increased stress and cortisol excretion can have negative effects on diverse body systems (5).

It is important to note that the difference in cortisol excretion between the high and low restraint groups was not explained by differences in overall perceived stress. Regression analysis indicated that only two variables predicted cortisol excretion: mean total water intake and dietary restraint group (with dietary restraint group accounting for 7.6% of the variance). The size of this effect is notable, both within the context of our study, and within the larger context of significant inter- and intra-individual variation in cortisol excretion (33).

We were surprised to find a relatively strong relationship between mean total water intake and cortisol excretion ($R^2 = 0.118, p = .01$). Although a previous report linked high fluid intake (5 L/d) and consequent high urine volume ($3.8 \pm 1.0$ L/d) to elevated cortisol excretion (34), other data do not support this relationship (35,36). It is possible that the effect of total water intake may be secondary to high dietary restraint: In an effort to limit energy intake, some women with high restraint may consume more fluids or foods with higher water content, and consequently have higher urine volumes. Consistent with this argument, high restraint women in our study consumed $\sim 300$ mL more total water than those with low restraint and excreted roughly that much more urine.

Although our results supported our primary hypothesis that high cognitive dietary restraint would be associated with higher urinary cortisol excretion, we did not find negative effects in bone. It is important to note that our study was not powered to detect differences in bone. Particularly given the heterogeneity in bone density following menopause, many more women would be required in cross-sectional studies to make conclusions regarding effects in bone (or the lack thereof).

Previously, the vast majority of research on dietary restraint has focused on young women. An exception was the reports of Bathalon, Hays, and colleagues (22,37,38), in which correlates of dietary restraint were examined in postmenopausal, 55- to 65-year-old women. They reported that dietary restraint was not associated with self-report of various health conditions (37), nor was it directly associated with weight gain or BMI (38) in large survey samples. However, in a smaller study (22), they found that women with high restraint (also defined as a TFEQ-R score $\geq 13$) differed from those with low restraint only in that they had lower hemoglobin levels (although values for both groups fell in the normal range). BMD was measured in that study, and no difference was found between the high and low restraint groups (22), although the study also lacked sufficient statistical power to detect cross-sectional differences in bone. These results suggest a lack of substantive health differences between postmenopausal women with high versus low dietary restraint. However, associations among cortisol excretion, stress, and dietary restraint were not examined.

Our data suggest that dietary restraint may be a relatively stable characteristic in women, given the high test–retest value for dietary restraint and the observation that women with high restraint reported being more likely to watch what they ate to control their weight in the past. Thus, weight-related concerns seen in many young women do not appear to diminish with age, and continue to act as a subtle stressor. And although the HPA axis response to a particular stressor can become habituated over time (39), our data suggest that habituation to the subtle stress of cognitive dietary restraint does not occur, as we found higher cortisol excretion in postmenopausal women with high dietary restraint despite the suggestion that their level of restraint had been high for many years.

Our finding of higher cortisol excretion among healthy postmenopausal women with high cognitive dietary restraint, combined with similar results from studies of young women, suggest that cognitive dietary restraint is a relatively consistent—and mildly stressful—characteristic at all life stages. Consequently, these women may not be as capable as their counterparts in adjusting to stressful situations as they age.
stages. As a group, our postmenopausal participants with high dietary restraint excreted roughly 20% more cortisol than did the low dietary restraint group, although group means fell well within the normal range. Whether this additional stress load has negative consequences for health has yet to be determined, as adequately powered studies with direct measurement of health outcomes are currently lacking. Prospective investigations are warranted to confirm observed differences in HPA activity and to further explore possible implications for health, particularly bone.

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