ENDOCRINE BALANCE AND THE TM-SIDHI PROGRAMME

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The TM-Sidhi programme was found to result in long-term changes in pituitary hormone levels with evidence of both increased sensitivity and stability in endocrine control systems.—EDITORS

Endocrinological effects of the TM-Sidhi programme were assessed in two separate experiments. In both experiments hormone levels were measured by standard radio-immunoassay in serum.

In experiment 1, eighteen male subjects were examined before instruction in the TM-Sidhi programme and again after 16 weeks of regular practice. Measurements of cortisol, ACTH, TSH, FSH, and LH were made, and the results compared by paired t-test. Significant reductions in cortisol, ACTH, and TSH were found, while FSH increased and LH remained unchanged at the end of the study period.

In experiment 2, eleven male subjects were assessed before learning the TM-Sidhi programme and after 5, 49, and 115 weeks of regular practice. Nine of these subjects were further assessed after 167 weeks of practice. Measurements of TSH, T4, T3, prolactin, growth hormone, and cortisol were made, and the results compared by ANOVA for repeated measures and Newman-Keuls’ test. Progressive and significant reductions in the levels of TSH, prolactin, and growth hormone were found. Cortisol and T4 were not significantly changed at the end of the study, although intervening changes did reach significance. T3 levels were slightly and significantly higher at the end of the study.

The mean coefficients of variation in levels of T4, T3, prolactin, and cortisol were markedly reduced after 115 weeks of practice of the TM-Sidhi programme. This reduction was significant for T4, prolactin, and cortisol when compared to before instruction, and for all four hormones when compared to the assessment made after 49 weeks of practice.

The findings indicate that the TM-Sidhi programme increases the sensitivity of the thyroid gland to TSH, produces long-term effects on the regulation of anterior pituitary function, and improves the stability of the endocrine system. These effects may be important in relation to the benefits for health and the reversal of ageing observed in previous research to result from the Transcendental Meditation and TM-Sidhi programme.

INTRODUCTION

Over the past decade a number of physiological studies have been conducted on the Transcendental Meditation and TM-Sidhi programme (21). Research conducted during the practice of the Transcendental Meditation technique has revealed such changes as marked reductions in O2 consumption, CO2 elimination, respiration rate, arterial lactate levels, and red cell lactate generation in vitro, an increase in
basal skin resistance, significant changes in the blood flow to various organs, including large increases in cerebral blood flow, and higher intra- and inter-hemispheric EEG coherence in the alpha and theta frequencies over the frontal and central areas of the brain (9, 11–13, 15, 19, 25, 26).

Endocrine changes observed include acute reductions in plasma cortisol during Transcendental Meditation (14), lower urinary free cortisol excretion in long-term practitioners of Transcendental Meditation (3), small increases in plasma prolactin towards the end of Transcendental Meditation (16), and reduced levels of serum growth hormone during Transcendental Meditation (2).

The purpose of the present study was to extend previous investigations by measuring longitudinal changes in hormone levels in experienced practitioners of the Transcendental Meditation technique, and in particular to assess the effects of the TM-Sidhi programme, a set of advanced procedures designed to enhance the benefits of the Transcendental Meditation technique for mental and physical functioning, and for mind-body co-ordination (5, 6, 21).

METHODS

EXPERIMENT 1—Eighteen male subjects with a mean age of 29.2 years (range 21–36 years) and a mean time of practising the Transcendental Meditation technique of 6.1 years (range 3–9 years) were studied. All were full-time students of Maharishi European Research University, Seelisberg, Switzerland. Samples were taken by venipuncture at 8 A.M. after an overnight fast on five consecutive days before and on three consecutive days 16 weeks after instruction in the TM-Sidhi programme. (For ACTH only two measurements pre-instruction and one post-instruction were carried out per subject.) Measurements of serum levels of adrenocorticotrophic hormone (ACTH), cortisol, thyroid stimulating hormone (TSH), follicle stimulating hormone (FSH), and luteinizing hormone (LH) were performed using radio-immunoassay at Tübingen University Paediatric Hospital, West Germany. Mean values were calculated for the two sessions and results compared by paired t-test.

EXPERIMENT 2—Eleven male subjects were studied with a mean age of 29.3 years (range 22–44 years) and a mean time of practising the Transcendental Meditation technique of 7.3 years (range 4–16 years). All were full-time students of Maharishi European Research University, Seelisberg, Switzerland. Samples were taken by venipuncture between 11 A.M. and 12 noon after an overnight fast on five consecutive days before instruction in the TM-Sidhi programme and again after 5, 49, 115, and 167 weeks of daily practice of the TM-Sidhi programme; (after 5 and 167 weeks samples were taken on three consecutive days only due to scheduling conflicts). Only nine subjects were available for the fifth session. Measurements of thyroid stimulating hormone (TSH), triiodothyronine (T$_3$), thyroxine (T$_4$), prolactin, growth hormone, and cortisol in serum were performed using radio-immunooassay by Hoffmann-La Roche Diagnostica, Schweizerhalle, Switzerland.

Means of the measurements for each subject at each session were calculated and tested for significant change by analysis of variance (ANOVA) for repeated measures and subsequently by Newman-Keuls’ comparisons where appropriate. These analyses were conducted for the nine subjects who were available for all five measurement sessions, and independently for the eleven subjects who were available for the first four measurement sessions.

The coefficients of variation for each hormone were calculated for each of the eleven subjects at the first, third, and fourth measurement sessions (these were the sessions when five samples were available for every subject). The results were tested by ANOVA (repeated measures) and Newman-Keuls’ comparisons.

RESULTS

EXPERIMENT 1—Mean changes in the different hormone levels and the results of statistical analysis are shown in table 1. Cortisol fell from 12.0 μg/100 ml before instruction in the TM-Sidhi programme to 10.1 μg/100 ml (p < .001) after 16 weeks of regular practice. ACTH fell from 0.59 mU/100 ml to 0.54 mU/100 ml (p < .05). TSH fell from 3.5 mU/l to 2.8 mU/l (p < .001). FSH rose from 135 ng/ml to 157 ng/ml (p < .05). LH increased from 33 ng/ml to 38 ng/ml, but this was not significant.

EXPERIMENT 2—The group mean changes in the different hormones are shown in table 2 for the nine subjects available at all five measurement sessions,
and in table 3 for the eleven subjects available at the first four sessions. Figures 1 to 6 also illustrate changes in group mean hormone levels for the nine subjects over five sessions.

**TABLE 1**  
**EXPERIMENT 1: CHANGES IN GROUP MEAN LEVELS OF HORMONES BEFORE AND AFTER INSTRUCTION IN THE TM-SIDHI PROGRAMME**

<table>
<thead>
<tr>
<th>HORMONE</th>
<th>BEFORE INSTRUCTION</th>
<th>AFTER 16 WEEKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cortisol (μg/100 ml)</td>
<td>12.0</td>
<td>10.1**</td>
</tr>
<tr>
<td>ACTH (μU/100 ml)</td>
<td>0.59</td>
<td>0.54*</td>
</tr>
<tr>
<td>TSH (mU/l)</td>
<td>3.5</td>
<td>2.8**</td>
</tr>
<tr>
<td>LH (ng/ml)</td>
<td>33</td>
<td>38</td>
</tr>
<tr>
<td>T3 (nmol/l)</td>
<td>89.14</td>
<td>8.4**</td>
</tr>
<tr>
<td>T4 (nmol/l)</td>
<td>10.1</td>
<td>2.29*</td>
</tr>
</tbody>
</table>

* p < .05, ** p < .001, paired t-test  

**TABLE 2**  
**EXPERIMENT 2: CHANGES IN GROUP MEAN LEVELS OF HORMONES BEFORE AND AFTER INSTRUCTION IN THE TM-SIDHI PROGRAMME FOR NINE SUBJECTS OVER FIVE SESSIONS**

<table>
<thead>
<tr>
<th>HORMONE</th>
<th>NUMBER OF WEEKS PRACTISING THE TM-SIDHI PROGRAMME</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before Instruction</td>
</tr>
<tr>
<td>TSH (mU/l)</td>
<td>8.8</td>
</tr>
<tr>
<td>T3 (nmol/l)</td>
<td>107</td>
</tr>
<tr>
<td>T4 (nmol/l)</td>
<td>2.04</td>
</tr>
<tr>
<td>Prolactin (μg/l)</td>
<td>12.5</td>
</tr>
<tr>
<td>GH (nmol/l)</td>
<td>0.04</td>
</tr>
<tr>
<td>Cortisol (μg/100ml)</td>
<td>14.3</td>
</tr>
</tbody>
</table>

* p < .05, ** p < .01, Newman-Keuls' comparisons between session 1 (before instruction) and subsequent sessions.

**TABLE 3**  
**EXPERIMENT 2: CHANGES IN GROUP MEAN LEVELS OF HORMONES BEFORE AND AFTER INSTRUCTION IN THE TM-SIDHI PROGRAMME FOR ELEVEN SUBJECTS OVER FOUR SESSIONS**

<table>
<thead>
<tr>
<th>HORMONE</th>
<th>NUMBER OF WEEKS PRACTISING THE TM-SIDHI PROGRAMME</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before Instruction</td>
</tr>
<tr>
<td>TSH (mU/l)</td>
<td>8.9</td>
</tr>
<tr>
<td>T3 (nmol/l)</td>
<td>109</td>
</tr>
<tr>
<td>T4 (nmol/l)</td>
<td>2.05</td>
</tr>
<tr>
<td>Prolactin (μg/l)</td>
<td>12.6</td>
</tr>
<tr>
<td>GH (nmol/l)</td>
<td>0.14</td>
</tr>
<tr>
<td>Cortisol (μg/100ml)</td>
<td>14.4</td>
</tr>
</tbody>
</table>

* p < .05, ** p < .01, Newman-Keuls' comparisons between session 1 (before instruction) and subsequent sessions.

For the nine subjects available at all sessions, the results were as follows:

- Mean TSH level fell progressively from 8.8 mU/l in the first session to 4.1 mU/l in the second, 1.9 mU/l in the third, 1.0 mU/l in the fourth, and 0.6 mU/l in the fifth. In five subjects at the fourth session, and in eight subjects at the fifth session, TSH levels were persistently below the limit of sensitivity of the assay (0.5 mU/l). In these cases the value of 0.5 mU/l was used for calculations. The ANOVA was significant (F(4, 32) = 239.75, p < .001). Newman-Keuls' comparisons revealed that the reductions in mean TSH levels between all pairs of sessions were significant (p < .01 in each case), except for that between the fourth and fifth session which was not significant.

- Mean T4 level fell from 107 nmol/l in the first session and 108 nmol/l in the second to 85 nmol/l in the third, then rose to 109 nmol/l in the fourth, and was similar at 105 nmol/l in the fifth. The ANOVA was significant (F(4, 32) = 19.00, p < .001). Newman-Keuls' comparisons revealed that the mean T4 level at the third session was significantly lower than that at all other sessions (p < .01 in each case). No other differences were significant.

- Mean T3 level rose from 2.04 nmol/l in the first session and 2.01 nmol/l in the second to 2.45 nmol/l in the third, then dropped to 2.02 nmol/l in the fourth, and rose again to 2.29 nmol/l in the fifth. The ANOVA was significant (F(4, 32) = 5.45, p < .005). Newman-Keuls' comparisons revealed that the mean T3 level at the third session was significantly higher than that at the first, second, and fourth sessions (p < .01 in each case). The only other significant difference was between the first and fifth session (p < .05).

- Mean prolactin level fell progressively from 12.5 μg/l in the first session to 10.4 μg/l in the second, 5.0 μg/l in the third, and 3.6 μg/l in the fourth, and then rose to 4.4 μg/l in the fifth. The ANOVA was significant (F(4, 32) = 70.07, p < .001). Newman-Keuls' comparisons revealed that mean prolactin levels decreased significantly from the first to the second session, and from the second to the third session (p < .01 in both cases). Subsequent changes were not significant, although levels remained significantly below those of the first and second sessions (p < .01 in both cases).
Mean growth hormone level fell progressively from 0.14 nmol/l in the first session to 0.12 nmol/l in the second, 0.10 nmol/l in the third, 0.07 nmol/l in the fourth, and 0.04 nmol/l in the fifth session. Eleven of the 27 growth hormone measurements of the fifth session were below the limit of sensitivity of the assay (0.01 nmol/l). In these cases, the value of 0.01 nmol/l was used for calculations. The ANOVA was significant ($F(4, 32) = 5.40, p < .005$). Newman-Keuls' comparisons revealed that the reduction in mean growth hormone level between the first and fourth sessions was significant ($p = .05$). Furthermore, the level at the fifth session was significantly lower than those at the first and second sessions ($p < .01$ in both cases). The remaining comparisons were not significant.
Mean cortisol level rose from 14.3 μg/100 ml in the first session to 18.6 μg/100 ml in the second, then fell to 8.7 μg/100 ml in the third, rose to 13.9 μg/100 ml in the fourth, and remained similar at 13.8 μg/100 ml in the fifth session. The ANOVA was significant (F(4, 32)=23.11, p<.001). Newman-Keuls' comparisons revealed that the mean cortisol level at the second session was significantly higher than that at all other sessions (p<.01 in each case), while the level at the third session was significantly lower than that at all other sessions (p<.01 in each case). Levels at the first, fourth, and fifth sessions were not significantly different from one another.

Data analysis for the eleven subjects available for the first four sessions yielded the same levels of significance on the ANOVA for TSH, T₄, prolactin, and cortisol as those presented above for nine subjects over five sessions; the ANOVA for eleven subjects over four sessions was significant at the .05 level for T₃, and was not significant for growth hormone.

Newman-Keuls' comparisons also gave the same levels of significance for changes in TSH, T₄, and cortisol as those presented above. For prolactin the only difference was in the comparison between the third and fourth sessions which reached significance at the .05 level. For T₃ the difference between sessions 2 and 3 was not significant with data from eleven subjects, while the differences between session 3 and sessions 1 and 4 were significant at the .05 level.

For TSH, growth hormone, and prolactin all values of the fifth session were below those of the first session. In every subject, mean TSH and growth hormone levels decreased progressively from the first to the fifth session, while mean prolactin levels decreased progressively from the first to the fourth session.

Mean coefficients of variation for T₄, T₃, prolactin, growth hormone, and cortisol are shown in table 4.

<table>
<thead>
<tr>
<th>NUMBER  OF  WEEKS PRACTISING THE TM-SIDHI PROGRAMME</th>
<th>TABLE 4 EXPERIMENT 2: MEAN COEFFICIENTS OF VARIATION (PER CENT) FOR T₄, T₃, PROLACTIN, GROWTH HORMONE, AND CORTISOL BEFORE AND AFTER INSTRUCTION IN THE TM-SIDHI PROGRAMME FOR ELEVEN SUBJECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>HORMONE</td>
<td>Before Instruction</td>
</tr>
<tr>
<td>T₄</td>
<td>10.6</td>
</tr>
<tr>
<td>T₃</td>
<td>10.0</td>
</tr>
<tr>
<td>Prolactin</td>
<td>16.5</td>
</tr>
<tr>
<td>Growth Hormone</td>
<td>47.1</td>
</tr>
<tr>
<td>Cortisol</td>
<td>16.3</td>
</tr>
</tbody>
</table>

* p<.05, ** p<.01, Newman-Keuls' comparisons between initial and subsequent assessments.
Changes in mean coefficients of variation were as follows:

- For T₄, there was a rise from 10.6% before instruction in the TM-Sidhi programme to 23.7% after 49 weeks of practice and then a fall to 1.9% after 115 weeks.
- For T₃, there was a rise from 10.0% to 18.8% followed by a fall to 2.5%.
- For prolactin, there was a rise from 16.5% to 21.0% and then a fall to 5.4%.
- For growth hormone, there was a rise from 47.1% to 48.3% and then to 61.7%. (This increase was largely due to a single value without which the group mean becomes 49.2%.)
- For cortisol, there was a rise from 16.3% to 26.6%, and subsequently a fall to 6.3%.

The ANOVA was significant at the .025 level for T₄, at the .005 level for prolactin, at the .001 level for T₄ and cortisol, and not significant for growth hormone. Newman-Keuls' comparisons revealed that the initial elevations in mean coefficients of variation were significant for T₄ and cortisol (p<.01) and not significant for T₃ and prolactin. The reduction in variation of hormone levels between 0 and 115 weeks of practice of the TM-Sidhi programme was significant at the .01 level for cortisol, at the .05 level for T₄ and prolactin, and was not significant for T₃.

The simultaneous, long-term reductions in TSH, prolactin, and growth hormone, indicate a profound and interesting effect of the TM-Sidhi programme on the regulation of anterior pituitary function. Control of anterior pituitary secretion is known to involve such factors as neurotransmitter levels in the hypothalamus, hypothalamic releasing and inhibitory factors, and pineal function. In the context of the present findings, reduced TRH (thyrotropin releasing hormone) secretion would be expected from the observed reductions in TSH levels. Also of possible importance are increased dopamine levels in the hypothalamus which would inhibit both prolactin and TSH secretion (4, 17). Pineal secretion of melatonin suppresses the secretion of TSH, prolactin, and growth hormone via increased somatostatin secretion from the hypothalamus (18, 22, 24). However, FSH would be inhibited by melatonin, whereas in experiment 1 it was noted to increase.

More research to elucidate these changes further would be valuable: this should include long-term studies of other pituitary hormones and studies of pineal and hypothalamic function.

Another effect of the TM-Sidhi programme, revealed by these findings, is on endocrine stability. A number of hormones are known to be secreted in bursts, causing significant ultradian fluctuations (1). The day-to-day variations seen within measurement sessions in this study presumably reflect such ultradian fluctuations. The greatly reduced variations after two years of practice of the TM-Sidhi programme may therefore signify reduced ultradian fluctuations. We would suggest further research utilizing 24-hour studies in order to examine more carefully this phenomenon of increased endocrine stability.

In conclusion, the TM-Sidhi programme appears to have marked longitudinal effects on endocrine functioning, particularly of the pituitary gland.
These findings are of particular interest in the light of the numerous beneficial effects of the Transcendental Meditation and TM-Sidhi programme on mental and physical health (7, 8, 20, 27, 29, 30).

The functioning of the neuroendocrine system is thought to be an important determinant of the rate of physical ageing (10). Neuro-endocrine theories of ageing suggest that failure of central regulatory processes causes ageing in the peripheral aspects of the physiology due to homeostatic imbalance. The greater stability and sensitivity of endocrine control seen in the present study could thus be an important factor in the reversal of biological ageing observed to accompany the development of higher states of consciousness through the Transcendental Meditation and TM-Sidhi programme (23, 28).

REFERENCES


