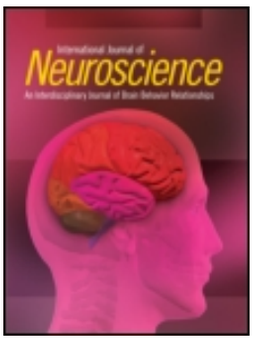

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CORTISOL DECREASES AND SEROTONIN AND DOPAMINE INCREASE FOLLOWING MASSAGE THERAPY

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In this article the positive effects of massage therapy on biochemistry are reviewed including decreased levels of cortisol and increased levels of serotonin and dopamine. The research reviewed includes studies on depression (including sex abuse and eating disorder studies), pain syndrome studies, research on autoimmune conditions (including asthma and chronic fatigue), immune studies (including HIV and breast cancer), and studies on the reduction of stress on the job, the stress of aging, and pregnancy stress. In studies in which cortisol was assayed either in saliva or in urine, significant decreases were noted in cortisol

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levels (averaging decreases 31%). In studies in which the activating neurotransmitters (serotonin and dopamine) were assayed in urine, an average increase of 28% was noted for serotonin and an average increase of 31% was noted for dopamine. These studies combined suggest the stress-alleviating effects (decreased cortisol) and the activating effects (increased serotonin and dopamine) of massage therapy on a variety of medical conditions and stressful experiences.

Keywords cortisol, dopamine, massage therapy, serotonin

Massage therapy has been noted to significantly alter the biochemistry of humans both immediately following massage sessions and over the course of massage therapy treatment periods. These studies can be grouped according to the type of condition: depression as a primary diagnosis; depression-related disorders, including sexual abuse and eating disorders (anorexia and bulimia); pain syndromes, including burn trauma, juvenile rheumatoid arthritis and migraine headaches; autoimmune conditions, including asthma and chronic fatigue; immune conditions, including HIV and breast cancer; and normal stress conditions, including job stress, the stress of activity, the stress of aging, and pregnancy stress. Accordingly, these studies are reviewed individually by their grouping. Although each condition may be affected by massage therapy in some unique ways, some effects generalize across these highly variable conditions. Of these, the stress reduction effects (cortisol reduction) of massage therapy and the activation effects (increased serotonin and dopamine) would appear to generalize across conditions.

Cortisol is notably a culprit variable deriving from stressful conditions and ultimately negatively affecting immune function. Cortisol is an end-product of the sympathetic system, the hypothalamic-pituitary-adrenal-cortical axis. Its production reliably increases following experimentally induced stress and reliably decreases following relaxing therapies such as massage therapy. Cortisol has been labeled a culprit variable for killing immune cells, most particularly natural killer cells, those cells in the immune system that kill cancer and viral cells. Thus, it is perhaps not surprising that cortisol reduction following massage therapy has been noted in conditions ranging from job stress to depression to HIV and breast cancer. In most studies cortisol has been sampled before and after the massage therapy session in saliva to document the immediate effects of a massage therapy session. Traditionally, the saliva has been collected using dental swabs (or syringe tubes in the case of infants), although a simpler, less invasive assay has recently been developed

that involves a simple litmus paper placed on the tongue. Thus, cortisol is relatively easy to collect in a non-invasive and a cost-effective manner. For an assessment of longer term effects of massage therapy, cortisol has been assayed from urine samples typically collected at the beginning of the month of therapy and at the end of the month. This is the more invasive and more costly assay.

Serotonin is an activating central nervous system neurotransmitter. Serotonin is typically assayed from metabolite derivatives (5HIAA) taken from urine samples. The synthetic counterpart of serotonin can be found in many antidepressant medications including Prozac and in many anti-pain medications. Serotonin is thought to interact with dopamine and cortisol in complex ways, although it can generally be said that serotonin enhances the production of dopamine and hampers the production of cortisol.

Dopamine is also a central nervous system neurotransmitter that has activating properties. Cocaine, for example, is noted to enhance the release of dopamine leading to the active state noted for that drug use. Dopamine, like serotonin, is notably involved in the reduction of depression and its stress effects.

DECREASED CORTISOL FOLLOWING MASSAGE THERAPY

Depression as a Primary Diagnosis

Pregnancy Depression. Depression has significant negative effects on pregnancy including the negative outcomes of prematurity and low birthweight. The incidence of pregnancy depression has been variously estimated at 20 to 40%. In a recent study conducted by Field et al. (2004), 84 depressed pregnant women were recruited during the second trimester of pregnancy and randomly assigned to a massage therapy, progressive muscle relaxation or a control group that received standard prenatal care alone. These groups were compared to each other and to a nondepressed group at the end of pregnancy. The massage therapy group participants received 2 20-min therapy sessions by their significant others each week for 16 weeks of pregnancy starting during the second trimester. The relaxation group engaged in progressive muscle relaxation sessions on the same time schedule. Immediately after the massage therapy sessions on the first and last days of the 16-week period the women reported lower levels of anxiety and depressed mood and less leg and back pain. By the end of the study the massage group had lower levels of saliva cortisol (↓23%) (see Table 1) and higher urine dopamine

Table 1. Cortisol level decreases (% decrease) in urine and saliva following massage therapy for different conditions

	Cortisol decrease	
Condition	Urine	Saliva
Depression as primary Dx		
Pregnancy depression	↓23	
Postpartum depression	↓28	↓28
lnfants of depressed mothers	↓53	↓33
Depressed children & adolescents	↓19	↓34
PTSD in children	↓30	↓11
Depression-related conditions		
Sex abuse	↓31	↓25
Anorexia		↓10
Bulimia	↓32	↓29
Pain		
Burn		↓20
JRA	↓31	↓25
Auto immune		
Asthma		↓37
Chronic fatigue	↓41	↓32
Immune		
HIV adults	↓45	
Stress conditions		
Job stress	↓24	
Activity stress		↓35
Hypertension	↓23	↓19
Ageing		↓28

(↑25%) (see Table 2) and serotonin levels (↑23%) following pregnancy massage (see Table 2). These changes may have contributed to the reduced fetal activity and the better neonatal outcome for the massage group (i.e., lesser incidence of prematurity and low birthweight) as well as their better performance on the Brazelton Neonatal Behavior Assessment Scale. The data suggest that depressed pregnant women and their offspring can benefit from massage therapy.

Postpartum Depressed Mothers. Maternal depression ranges from 25–30% during the first 3 months after delivery (O'Hara et al., 1984). Even mild depression and anxiety may affect the new mother's relationship with her child. For example, in one study postpartum depressed mothers demonstrated

Table 2. Dopamine and serotonin level increases (% increase) in urine following massage therapy for different conditions

Condition	Dopamine	Serotonin
Pregnancy depression	↑25	
Infants of depressed mothers		↑34
Anorexia	↑42	
Bulimia	↑30	
Migraine		↑13
Chronic fatigue	↑21	
Breast cancer	↑26	↑38
Pregnancy stress	↑25	

less rocking, gaze, and positive regard toward their infants than did nondepressed mothers (Livingood et al., 1983). Others have reported less frequent positive and more frequent negative states among depressed mother–infant dyads (Cohn et al., 1990; Field et al., 1990). Massage and relaxation therapy were expected to decrease the mothers' depressive and anxiety symptoms.

In a study on postpartum depression (Field et al., 1996), 32 depressed adolescent mothers received 10 30-min sessions of massage therapy or relaxation therapy over a 5-week period. The women were randomly assigned to each group. Although both groups reported lower anxiety following their first and last therapy sessions, only the massage therapy group showed behavioral and stress hormone changes including a decrease in anxious behavior and salivary cortisol levels (↓28%) (see Table 1). A decrease in urine cortisol levels (↓28%) suggested lower stress following the five-week period for the massage therapy group.

Infants of Depressed Mothers. Infants of depressed mothers are noted to experience depression symptoms similar to their mothers' symptoms including a similar biochemical profile (elevated cortisol and low levels of serotonin and dopamine), as well as other physiological and behavioral symptoms (Field et al., 2004). In an attempt to modify the depressed profile of infants of depressed mothers the authors recently conducted a massage therapy study with infants of mothers with those symptoms (Field et al., 1996a). In that study, 40 full-term 1- to 3-month-old infants born to depressed adolescent mothers were given 15 min of either massage or rocking for 2 days per week for a 6-week period. The infants who experienced massage therapy compared to infants in the rocking control group spent more time in active alert and active awake states, cried less,

and had lower salivary cortisol levels (↓33%), suggesting lower stress (see Table 1). After the massage versus the rocking sessions the infants spent less time in an active awake state, suggesting that massage may be more effective than rocking for inducing sleep. Over the 6-week period the massage therapy infants gained more weight, showed greater improvement on emotionality, sociability, and soothability temperament dimensions and had greater decreases in urinary cortisol (↓53%) (see Table 1) and increased serotonin (↑34%) (see Table 2).

Depressed Children and Adolescents. Depressed children and adolescents, particularly those hospitalized for their depression, are noted to have elevated stress hormones, including elevated cortisol and norepinephrine. In an attempt to lower the depression and cortisol levels of these children and adolescents the authors conducted a study on massage therapy in an inpatient psychiatric unit (see Field et al., 1992). A 30-min back massage was given daily for a 5-day period to 52 hospitalized depressed children and adolescents. Compared with a control group who viewed relaxing videotapes, the massaged subjects were less depressed and anxious and had lower saliva cortisol levels after the massage. In addition, nurses rated the children as being less anxious and more cooperative on the last day of the study, and nighttime sleep increased over this period. Finally, saliva cortisol levels decreased (↓34%) and urinary cortisol levels decreased (↓19%) (sec Table 1).

Posttraumatic Stress Disorder in Children. Posttraumatic stress disorder is frequently noted in children following natural disasters such as hurricanes. Symptoms frequently described by the children include depressed affect, numbing of responses, and conduct problems. Following Hurricane Andrew, teachers in the school affected by the hurricane suggested that people in these children's lives, namely their parents, were experiencing posttraumatic stress symptoms themselves that may have been a reason for their initiating less physical contact with their children at this time. The clinging behavior noted in the children suggested they were desiring more physical contact. Thus, the authors initiated a massage therapy study to add more physical contact and to alleviate their symptoms. In this study (Field et al., 1996c), 60 grade school children who showed classroom behavior problems following Hurricane Andrew were given massage therapy on 8 days 1 month after the hurricane. Scores on the PTSD Reaction Index suggested that the children were experiencing severe posttraumatic stress. As compared to a video attention control group, the children who received massage therapy reported being happier

and less anxious and had lower salivary cortisol levels (↓11%) and urinary cortisol levels (↓30%) after the therapy (sec Table 1). In addition, the massage therapy group showed more sustained changes as manifested by lower scores on the Children's Manifest Anxiety Scale, the Center for Epidemiological Studies Depression Scale, and self-drawings, and they were observed to be more relaxed. These positive effects were promising given the persistence of PTSD symptoms noted for children who have not received intervention following disasters such as hurricanes.

Depression-Related Disorders

This section reviews studies on depression-related disorders or disorders that are typically accompanied by depression including sex abuse and eating disorders, both anorexia and bulimia.

Sex Abuse. Sex abuse, particularly in women, is a relatively common event with some having suggested that more than 50% of women are sexually abused by the age of 18 (Russell, 1988). Massage was thought to be an effective therapy for women who had experienced sexual abuse because the positive touch could help them feel less negative about touch. In at least one other study, these women showed fewer physical ailments and a more relaxed body posture (Larsen & Pegaduan-Lopez, 1987). In the present study, women who had experienced sexual abuse were given a 30-min massage twice a week for one month (Field et al., 1997a). Immediately after the massage the women reported being less depressed and less anxious, and their salivary cortisol levels decreased following the session (↓25%) (see Table 1). Over the one-month treatment period, the massage therapy group experienced a decrease in depression amid in life event stress and in urine cortisol levels (↓31%). Although the relaxation therapy control group also reported a decrease in anxiety and depression, their stress hormones did not change, and they reported an increasingly negative attitude toward touch.

Common to the studies on all conditions in this depression-related group was a decrease in depressed mood and a decrease in anxiety. In as much as depressed mood and elevated anxiety both tend to accompany elevated cortisol levels, it is not clear whether the decrease in depressed mood or decrease in anxiety was mediating the decrease in cortisol noted in all these studies. Unique effects for each of these conditions were, of course, observed. For example, infants of depressed mothers who received massage therapy were noted to he less irritable and to have more organized sleep, which may in

themselves have contributed to the decreased level of cortisol and vice versa. The design of these studies and the small sample sizes preclude the assessment of directional effects and mediating effects that could be assessed, for example, by path analysis or structural equations analysis.

Eating Disorders

Anorexia. According to the American Psychiatric Association (1996) diagnostic system, anorexia features (1) a refusal to maintain normal body weight, (2) a fearful and irrational preoccupation of weight gain, body size, and body image despite being underweight, and (3) in females, the disturbance of the menstrual cycle resulting in amenorrhea (American Psychiatric Association 1996). Women with anorexia typically show symptoms of depression and anxiety (Formari et al., 1992) and higher cortisol levels (Turner & Shapiro, 1992). The authors conducted a massage therapy study to reduce the levels of depression and cortisol in women experiencing anorexia (Hart et al., 2001). In this study 19 women diagnosed with anorexia nervosa were given standard treatment alone or standard treatment plus massage therapy twice per week for five weeks. The massage group reported lower stress and anxiety levels and had lower saliva cortisol levels (↓10%) following massage therapy (see Table 1). Over the 5-week treatment period, they also reported decreases in body dissatisfaction on the Eating Disorder Inventory and showed increased dopamine levels (↑42%) (see Table 2).

Bulimia. Although bulimia was originally thought to derive from anorexia, the American Psychiatric Association has described it as a separate disorder. The diagnosis according to the APA (1997) includes the symptoms: (1) current binge eating (an average of two or more binge-eating episodes per week for at least three months) and (2) regular self-induced vomiting, strict dieting or fasting, and rigorous exercise in order to prevent weight gain, in at least one study, 20–30% of patients with bulimia met the diagnostic criteria for depression (Edelstein et al., 1989). In a study (Field et al., 1998b) conducted on massage therapy with bulimia, 24 female adolescent bulimic inpatients were randomly assigned to a massage therapy or a standard treatment control group. Results indicated that the massaged patients showed immediate reductions (both self-report and behavior observation) in anxiety and depression. In addition, by the last day of the therapy, the massage group had lower depression scores, lower urine cortisol levels (↓32%), and lower saliva cortisol levels (↓29%) (see Table 1); higher dopamine levels (↑30%) (see Table 2);

and showed improvement on several other psychological and behavioral measures. These findings suggest that massage therapy is effective as an adjunct treatment for bulimia.

Pain Syndromes

Burn Injuries. Patients with burn injuries typically experience depression and anxiety, which may affect their perception of pain (Patterson, 1992). Having a low pain threshold significantly affects their treatment procedures including skin brushing or debridement. In a study (Field et al., 1998a) conducted on burn injuries it was expected that massage therapy may increase pain threshold and thereby be of help through the debridement session. In this study, 28 adult patients with burns were randomly assigned before debridement to either a massage therapy group or a standard treatment control group. State anxiety and saliva cortisol levels decreased (↓20%) (see Table 1), and behavior ratings of state, activity, vocalizations, and anxiety improved after the massage therapy sessions on the first and last days of treatment. Longer term changes were also significantly better for the massage therapy group including decreases in depression and anger and decreased pain on the McGill Pain, Present Pain Intensity, and Visual Analogue Scales. Although the underlying mechanisms are not known, these data suggest that debridement sessions were less painful after the massage therapy sessions due to a reduction in pain, anger, and depression.

Juvenile Rheumatoid Arthritis. The diagnosis of juvenile rheumatoid arthritis is based on persistent arthritis for six or more weeks in one or more joints. Night pain and joint stiffness during the morning following periods of inactivity are common symptoms. Several alternative therapies have been explored because of the limited effects of anti-inflammatory drugs and the undesirability of using narcotics for pain reduction in children with arthritis. The use of massage therapy with this group of children was investigated (see Field et al., 1997b). Children with mild to moderate juvenile rheumatoid arthritis were studied who were massaged by their parents 15 min a day for 30 days (and a control group engaged in relaxation therapy). The children's anxiety and saliva cortisol levels decreased (↓25%) (see Table 1) after the massage therapy session and over the 30-day period their urine cortisol levels decreased (31%), and their pain decreased on self-reports, parent reports, and their physician's assessment of pain (both the incidence and severity) and pain-limiting activities.

Migraine Headaches. Stress may lead to dilation of blood vessels in the brain of patients who are prone to headaches and, in turn, may trigger a migraine. At least two studies have established the positive effects of massage therapy on reducing headaches (Hammill et al., 1996; Jensen et al., 1990). However, these studies lacked control groups as well as controls for the massage procedure. In the study conducted by the authors, 26 adults with migraine headaches were randomly assigned to a wait-list control group or to a massage therapy group who received two 30-min massages per week for 5 consecutive weeks (Hernandez-Reif et al., 1998). The massage therapy participants reported fewer distress symptoms, less pain, more headache-free days, and fewer sleep disturbances, and they showed an increase in serotonin levels (↑13%) (see Table 2). Synthetic serotonin medications have been effective for treating headaches. The natural production of serotonin can be used potentially to decrease the intensity and frequency of headaches.

In summary, the decrease in cortisol levels and, in the case of migraine headaches, the increase in serotonin levels, noted in these studies and the reduction of pain along with improved sleep suggests reduced stress. Again, it is not clear whether the change in stress led to the change in biochemistry or vice versa. Self-reports of improved mood and decreased anxiety might relate to enhanced sleep, reduced pain, and/or a change in the biochemical profile.

Autoimmune Conditions

Autoimmune conditions such as asthma, chronic fatigue syndrome, and fibromyalgia have been associated with stress including elevated depression, anxiety, and cortisol. Very little is known about the etiology of autoimmune conditions, and it is not clear the degree to which stress and stress hormones contribute to the autoimmune conditions. Although the symptoms that are altered by massage therapy are unique to each condition (e.g., respiratory function being enhanced in the case of asthma and pain being reduced in the case of fibromyalgia), these conditions have in common the reduction in cortisol levels.

Asthma. Children with asthma are noted to experience high anxiety levels, as are their parents. Because of the chronicity of asthma and because it was expected that parents would experience lower anxiety levels if they were to massage their children, parents were used as massage therapists in a study of children with asthma (Field et al., 1998c). In this study, 32 children with

asthma were randomly assigned to receive either massage therapy or relaxation therapy. The children's parents were taught to provide 1 therapy or the other for 20 min before bedtime each night for 30 days. The children who received massage therapy showed an immediate decrease in anxiety and saliva cortisol levels (↓37%) after massage (see Table 1). Also their attitude toward asthma and their peak air flow and other pulmonary functions improved over the course of the study. Thus, it appears that daily massage improves airway caliber and control of asthma, possibly due to a decrease in anxiety and cortisol levels.

Chronic Fatigue Syndrome. Chronic fatigue syndrome has been clinically defined as (1) the new onset of chronic, debilitating fatigue that does not disappear with bedrest and has been noted to reduce the individual's activity level as much as 50% for a period of 6 months and (2) the exclusion of other conditions that could produce the same symptoms as determined by medical history, clinical exam, or laboratory test. Other symptoms that have been associated with chronic fatigue syndrome include depression, with as many as 58% of this population experiencing depression. In the authors' study on chronic fatigue, 20 subjects with chronic fatigue were recruited from local physicians (Field, Sunshine, Hernandez-Reif, et al., 1997). The patients were then randomly assigned either to massage therapy or to a sham (transcutaneous electrical stimulation) group used as a control group. Characteristic of the incidence of chronic fatigue at large, the sample was primarily women (80%). The massage therapy group reported fewer depressive symptoms following the massage therapy sessions and by the end of the massage therapy period. They also reported lower anxiety levels and less pain. They had fewer fatigue symptoms and somatic symptoms, and they experienced less pain by the end of the study. Their saliva cortisol levels decreased (32%) (see Table 1) after the first session and the last session, and their urine cortisol levels decreased (↓41%) across the course of the study, although their urine dopamine levels increased (↑21%) (see Table 2).

Once again, as in the previous conditions treated by massage therapy, these patients with autoimmune conditions not only showed improvement in their clinical condition but also showed a decrease in cortisol, an increase in dopamine (in the case of chronic fatigue), and a decrease in self-reported depression and anxiety. The direction of effects, again, is unknown. Further study is needed on whether the improved clinical conditions led to a reduction in the depressed and anxious mood states and, in turn, changes in the biochemistry, or whether the direction of effects was opposite.

Immune Disorders. Immune disorders are likely to be most affected by elevated cortisol inasmuch as cortisol has been noted to kill immune cells, specifically natural killer cells. Natural killer cells in turn, kill viral and cancer cells. The reduction in cortisol would he expected to lead to an increase in natural killer cells that, in turn, would be expected to improve conditions like HIV and cancer. In the case of the two studies reviewed here, one on HIV and one on breast cancer, both decreases in cortisol and increases in natural killer cells were noted.

HIV. In this study (see Ironson et al., 1996), 29 men (20 HIV+, 9 HIV–) received daily massages for 1 month. A subset of 11 of the HIV+ participants served as a within subjects control group (1 month with and 1 month without massages). Major neuroendocrine findings, measured via 24-h urines included a significant decrease in urine cortisol (↓45%) (see Table 1). Major immune findings after the month of massage included a significant increase in natural killer cell number. Decreases in anxiety and increases in relaxation were significantly correlated with the increased natural killer cell number.

Breast Cancer. Approximately 1 in 9 women in the United States is diagnosed with breast cancer, which is the leading cause of cancer death in women between the ages of 15 and 54. Breast cancer has been associated with psychological distress including depression and anxiety, which, in turn, has been correlated with lower natural killer cells and natural killer cell activity. Lower levels of natural killer cells present a problem inasmuch as these have an important role in cancer defense by fighting tumor and virus-infected cells. In a number of cancer studies, for example, lower cancer recurrence at a five-year follow-up was predicted by higher natural killer cell activity. Natural killer cell levels are notably higher when cortisol levels are lower. Massage therapy has been effective in increasing serotonin and dopamine levels, which are noted to decrease cortisol levels, thereby increasing natural killer cell number. The authors' breast cancer study examined the effects of massage therapy on enhancing serotonin and dopamine levels, reducing cortisol levels, and increasing natural killer cell levels (Hernandez-Reif et al., 2004). Thirty-four women diagnosed with stage 1 or 2 breast cancer were randomly assigned postsurgery to a massage therapy group (30-min massages 3 times per week for 5 weeks) or a control group. The massage consisted of stroking, squeezing, and stretching the head, arms, legs/feet, and back. Results showed that massage therapy had immediate effects, including reduced anxiety, depressed mood, and anger. Longer term massage effects included reduced

depression and hostility and increased urinary dopamine (↑26%) (see Table 2), serotonin (↑38%) (see Table 2), and natural killer cell number and lymphocytes. Although the direction of effects has not been assessed because the samples are too small for conducting path analyses, the expected pathway would involve increased serotonin and dopamine contributing to lower cortisol levels, in turn contributing to elevated natural killer cell levels and natural killer cell activity.

Stress Conditions. In this section the studies reviewed involve stressful conditions, including job stress, physical activity stress, hypertension, pregnancy stress, and ageing stress. These stressful conditions might be expected to contribute to elevated cortisol and, thereby, compromised immune function.

Job Stress. Healthcare workers are prime candidates for high stress levels. In a study (see Field et al., 1997) on healthcare workers the authors examined the immediate effects of 15-min chair massages at a major public hospital. Results showed decreases in job stress, anxiety, and depression. In addition, EEG patterns changed in the direction of heightened alertness and math computations were performed faster and with fewer errors. Finally, urine cortisol levels decreased (↓24%) (see Table 1).

Activity Stress. Dance is often performed at the extreme range of motion and can thus be stressful for the body as muscles are shortened or stretched. Various forms of therapies, including massage therapy, have been used for injury prevention, for treating muscle soreness, and for improving range of motion. In a study (Leivadi et al., 1999), 30 female university dancers were randomly assigned to a massage therapy or relaxation therapy group. The therapies consisted of 30-min sessions twice a week for 5 weeks. Both groups reported less neck, shoulder, and back pain after the treatment sessions and reduced back pain across the study. However, only the massage therapy group showed increased range of motion across the study, including neck extension and sl1oulder abduction. Both groups reported less depressed mood and decreased anxiety levels. However, saliva cortisol decreased (35%) only for the massage therapy group (see Table 1).

Hypertension. High blood pressure is associated with elevated anxiety, stress, and stress hormones. Massage therapy and progressive muscle relaxation were evaluated as treatments for reducing blood pressure and these

associated symptoms. Adults who had been diagnosed as hypertensive received 10 30 min massage sessions over 5 weeks or they were given progressive muscle relaxation instructions (control group). Sitting diastolic blood pressure decreased after the first and last massage therapy sessions and reclining diastolic blood pressure decreased from the first to the last day of the study. Although both groups reported decreased anxiety, only the massage therapy group reported decreased depression and showed decreased urine cortisol (↓23%) and saliva cortisol (↓19%).

Pregnancy Stress. Recent studies have suggested that pregnant women with elevated cortisol (which is related to higher depression and anxiety) gave birth to newborns with higher cortisol levels and depression-like symptoms that mimic their depressed mothers' symptoms. Physicians are reluctant to prescribe antidepressants and anti-anxiety medications because of the effects on the fetus and the newborn. Alternative therapies, such as massage therapy, have been used to lower stress in the prenatal period. In a study on pregnancy stress (Field, et al., 1999), 26 pregnant women were assigned to a massage therapy or relaxation therapy group for 5 weeks. The therapies consisted of 20-min sessions twice a week. Both groups reported feeling less anxious after the first session and less leg pain after the first and last sessions. Only the massage therapy group, however, reported reduced anxiety, improved mood, better sleep, and less back pain by the last day of the study. In addition, urine dopamine levels increased (↑25%) (see Table 2) for the massage therapy group, and the women had fewer complications during labor, and their infants had fewer postnatal complications, including a lower incidence of prematurity.

Aging Stress. Research shows that elderly people are prone to feelings of loneliness, depression, and decreased immune function, possibly because they receive less touch. In the authors' study on elderly retired individuals who were volunteering at a home for children, the effects of the elderly retired volunteers giving a massage to infants were compared with their receiving massage themselves (Field et al., 1998), 3 times a week for 3 weeks. Receiving massage first versus giving massage first was counterbalanced across subjects. Immediately after the first- and last-day sessions of giving massages, the elder retired volunteers had less anxiety and depression and lower saliva cortisol levels (4.28%). Their lifestyle and health also improved, possibly because their lower cortisol levels led to improved immune function. These effects were not as strong for the 3-week period when they received massage versus when they

gave massage, possibly because the elder retired volunteers initially felt awkward about being massaged and because they derived more satisfaction massaging the infants. This study suggests that persons giving massage may experience similar effects as those receiving massage.

SUMMARY

Thus, positive changes have been noted in biochemistry following massage therapy including reduced cortisol and increased serotonin and dopamine. Many conditions were positively affected by massage therapy including depression and depression-related conditions, pain syndromes, autoimmune and immune chronic illnesses, and stress conditions. The underlying mechanisms for their effects remain to be understood.

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