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Pregnant women benefit from massage therapy

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ABSTRACT

Twenty-six pregnant women were assigned to a massage therapy or a 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 session. 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, urinary stress hormone levels (norepinephrine) decreased for the massage therapy group and the women had fewer complications during labor and their infants had fewer postnatal complications (e.g., less prematurity).

INTRODUCTION

Negative symptoms associated with the physical and physiological changes occurring during pregnancy have been shown to impact on the well-being of the mother and fetus. Structural stress on the lower back, for example, frequently causes back and leg pain[1]. Common physical symptoms such as edema, muscle spasms, cramps and fatigue, may lead to difficulty sleeping due to disco0mfort and body pains[2,3]. If the symptoms are perceived as stressors by the pregnant women, stress hormones may be released[3], which in turn may affect fetal behavior, such as leading to more time in quiet fetal sleep, less gross body movement during active sleep[4], and less optimal neonatal behavior[5,6].

Recent research has revealed that depressed pregnant women with elevated cortisol and norepinephrine levels gave birth to newborns with depression-like symptoms[7], higher cortisol and norepinephrine levels (stress hormones)[6] and right frontal EEG activation mimicking their depressed mothers' EEG patterns[8]. Stress has also been implicated as an abortogen[9]. In addition, exposure to conditions that stimulate stress hormones (including catecholamines, cortisol, and neuropeptides) during pregnancy negatively impacts birth weight and may lead to pre-eclampsia, preterm labor, and intrapartum complications[10]. Maternal anxiety has also been shown to have a significant impact postnatally. For example, anxiety and depression are associated with feeding problems, and anxious mothers perceive their infants as being fussy, hungry, and demanding[11].

Drug therapy to treat symptoms during pregnancy might affect fetal development. This was found in one study where infants of mothers who received antipsychotic and anti-anxiety medications during pregnancy exhibited poor neonatal motor functioning, including tremulousness, hypertonicity, and poor motor maturity[12]. Some natural and alternative treatments have been shown to effectively treat pregnant women without the risks or side-effects associated with some medications. These include deep muscle relaxation and cognitive control methods which have been shown to reduce perceived stress and increase coping skills in

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pregnant adolescents[13]. A combination of relaxation, skin warming biofeedback, and physical therapy has been shown to effectively reduce headaches in pregnant women[14,15].

Although massage therapy has not been studied as a treatment for the symptoms associated with pregnancy, massage during labor has been shown to reduce labor time, hospital stay and to decrease postpartum depression[16]. Massage therapy has also been shown to decrease salivary cortisol and urinary cortisol and norepinephrine in depressed adolescent mothers[17], to decrease chronic lower back pain[18], to reduce anxiety and improve mood in women experiencing premenstrual syndrome[19], and to improve sleep patterns[20]. In the present study, massage therapy was expected to have a positive impact on pregnant women by decreasing stress hormones and potential stressors, such as anxiety, leg and back pain. Improvements in mood, sleep and fetal attachment were also expected.

METHODS

Participants

Twenty-six pregnant working women between 23 and 35 years old (mean ±SD: 29.5 ± 2.7) were recruited from obstetric and gynecology clinics and through community advertisements. Working pregnant women were chosen because research shows that they experience more anxiety than non-working pregnant women[21]. Participants reported an interest in participating in relaxation sessions to reduce stress. Women were recruited during their second trimester, between 14 and 30 weeks gestation (23.5 ± 4.6) and randomly assigned to a massage therapy or progressive muscle relaxation group. The two groups were demographically comparable and were from middle socio-economic status families (mean of 1.9 on the Hollingshead Two-Factor Index), whose ethnicity was distributed 46% Caucasian, 39% Hispanic, 12% African-American and 3% Asian. The two groups did not differ on demographic variables (see Table 1).

Table 1 Mean (±SD) demographic variables for the massage therapy and relaxation groups

	Massage *(n=14)*	*Control* *(n=12)*	*Significance* χ^2	*t-test*
Maternal age (years)	29(3)	30(2)		0.293
Gestation (weeks)	23.3(4)	23.6(5)		0.887
Socioeconomic status			0.692	
I (upper)	3	4		
II (upper middle)	7	6		
III (middle)	4	2		
Ethnicity			0.588	
Caucasian	5	7		
Hispanic	2	1		
African-American	6	4		
Other	1			

Procedures

Massage therapy

Starting in their second trimester, subjects in the massage group received ten 20-min massages over 5 weeks (i.e. two massages per week for 5 weeks). The massages were conducted by trained massage therapists. Each session began with the mother in a side-lying position, with pillows positioned behind the back and between the legs for support. The massage was administered in the following sequence for 10 mins.

(1) Head and neck: massaging the scalp, making small circles from the forehead, along the hairline and down to temple, and kneading the neck from the base up.
(2) Back: using the heel of the hands, moving along the spine; using the palms moving hands with rocking movements from the top of the shoulder blade to the backbone; pressing fingertips, along both sides of the spine from the neck to the backbone and then stroking upward from the hip to the neck; stroking the shoulder muscles (trapezius); inching up the back, using fingertips placed on sides of spine, starting from the hipbone to the neck and then reversing the direction downward using fingertips in a raking fashion; massaging the lower back from the backbone across the waistline using the heel of the palm to make large circles; long gliding strokes from the hip up and over the shoulder.
(3) Arms: making long sweeping strokes from the elbow up and over the shoulder; kneading the muscles from above the elbow to the shoulder; stroking from the wrist to the elbow; kneading the muscles between the wrist and the elbow.
(4) Hands: massaging the hand using thumbs to make small circles to the palm; on the back of

the hand, rubbing between the spaces to the bones; sliding down each finger.

(5) Legs: long sweeping strokes from the knee to the thigh, up and over the hip; kneading the muscles between the knee and thigh; long sweeping strokes from the ankle up toward the knee; kneading the muscles between the ankle and knee; sliding the hand from the Achilles tendon up towards the upper calf, and sliding down to the heel with less pressure several times.

(6) Feet: massaging the soles from the toes to the heel with fingers and thumbs and moving back towards the toes; sliding down each toe and rotating toe three times; stroking top of foot towards leg.

The routine was repeated with the mother lying on her other side supported by pillows.

Relaxation therapy

A relaxation group, as opposed to a pure control group, was used for comparison. This group controlled for potential placebo effects, or potential improvement related to the increased attention given to the massage subjects. The relaxation group was given instructions on how to conduct progressive muscle relaxation sessions while laying quietly on the massage table. A session lasted 20 mins and consisted of tensing and relaxing large muscle groups starting with the feet and progressing to the calves, thighs, hands, arms, back and face. The subjects were asked to conduct these sessions at home twice a week for five weeks.

Pre–post treatment measures (immediate effects)

These assessments were made before and after the sessions on the first and last days of the 5 week study.

State Anxiety Inventory (STAI)[22]

This was administered to determine anxiety status. The STAI comprises of 20 items and assesses how the subject feels at that moment in terms of severity, from (0) 'not at all' to (4) 'very much so'. Typical items include 'I feel nervous' and 'I feel calm'. The STAI scores range from 20 to 80 and increase in response to stress and decrease under relaxing conditions. Research has demonstrated that the STAI has adequate concurrent validity[23] and internal consistency ($r = 0.83$).

Profile of Mood States Depression Scale (POMS-D)[24]

The POMS consists of 15 adjectives rating depressed mood 'right now' on a 5-point scale ranging from (0) 'not at all' to (4) 'extremely' using words such as 'blue' and 'sad'. The scale ranges from 0 to 60 and has adequate concurrent validity, good internal consistency ($r = 0.95$)[25] and it is an adequate measure of intervention effectiveness [26].

VITAS[27]

Participants completed pre- and post-session pain scales, with reference to leg and back pain, on the first and last day of the study. Pain perception was rated on a visual analog scale (VAS) ranging from 0 (no pain) to 10 (worst possible pain) and anchored with 5 faces. The faces, located at two point intervals, ranged from very happy (0), to happy (2), contented (4), somewhat distressed (6), distressed (8), to very distressed (10). Highly acceptable scores for criterion-related validity were established by correlating the VITAS with sleep disturbance ($r = 0.63$, $p < 0.01$) since body pain has been associated with difficulty sleeping [2,3].

First–last day session measures (longer-term effects)

On the first and last days of the 5 week study, the following assessments were administered.

Center for Epidemiological Studies-Depression[28]

This 20 item scale rates depressive symptoms (e.g. 'I feel lonely') over the past week on a four-point scale: (0) 'rarely' (1) 'some of the time', (2) 'occasionally', and (3) 'most of the time'. Scores range from 0 to 60, with a score of 16 or higher reflecting depressive symptoms. Reliability and validity for this scale have been acceptable across a variety of demographic characteristics including age, education and ethnic groups[29,30].

Perinatal Anxieties and Attitudes Scale[31]

This is a 32 item questionnaire consisting of questions regarding *pregnancy* ('Were you happy

during this pregnancy?', 'Were you looking forward to having a baby?') *labor and birth* ('Were you frightened when you reached the hospital?', 'Were your labor pains worse than you expected'), *post birth* ('Do you want to breastfeed your baby?', 'Are you afraid you won't know what to do with your baby?'), and *pregnancy and onset* ('Did you plan to have this baby?', 'Were you angry when you first knew you were pregnant?'). It utilizes reverse scored items and the responses are based on yes/no responses. The percentage of optimal responses for each subscale is recorded, with a higher score being optimal.

Maternal-Fetal Attachment Scale[32]

This 32-item scale provides three subscale scores: fetal attachment, maternal feelings, and social support. Responses are rated on a 5 point Likert scale from (0) 'False or Definitely No' to 'True or Definitely Yes' (4). Reverse score items are included and typical items are 'I talk to my unborn baby' and 'I am sorry I became pregnant'. A higher score is optimal.

Sleep Scale[33]

Questions on this 15-item scale are rated on a visual analog anchored at one end with effective sleep responses (e.g., 'Did not awaken', 'Had no trouble sleeping') and at the opposite end with ineffective responses (e.g., 'Was awake 10 hours', 'Had a lot of trouble falling asleep'). Subjects place a mark across the answer line at the point that best reflects their last night's sleep. The scale yields subcategories of *sleep disturbance* ('I had a lot of trouble with disrupted sleep'), *sleep effectiveness* ('Awoke refreshed') and *supplementary sleep* ('After morning awakening, slept on and off'). Higher scores suggest more effective sleep on the effectiveness scale and lower scores are optimal on the disturbance and supplementary scales and suggest less disturbed sleep and less need for additional sleep (e.g., daytime naps), respectively. Satisfactory reliability has been reported for this scale[34].

Urine samples

Urine samples were collected on the first and last days of the study and assayed for cortisol, catecholamines (norepinephrine, epinephrine, dopamine) and serotonin (5-HIAA). Based on previous literature, decreased cortisol and catecholamines were expected for the massage group by the end of the 5 week study[17,35].

Obstetric Complications (OCS) and Postnatal Factor (PNF) Scales[36]

Following delivery, obstetric complications and perinatal factors were quantified using the OCS and PNF scales. The OCS is a 41-item scale that assesses optimality of the *prenatal* (e.g., maternal age, medical problems during pregnancy, length of time since last pregnancy), *obstetrics* (e.g., delivery type, drugs given to mother during labor and delivery, fetal heart rate during labor) and the *neonatal* period (e.g., placenta previa, onset of stable respiration, Apgar scores). A higher score is optimal and indicates fewer complications.

The PNF is a 10-item scale that assesses complications of the newborns (e.g., respiratory distress, temperature disturbance, feeding within 48 hours). A higher score is more optimal. The OCS and PNF were completed after delivery from information collected from the medical records.

RESULTS

Repeated measures by group (massage/ relaxation) MANOVAs and ANOVAs were conducted. The repeated measures were the pre- and post-massage therapy or relaxation session measures for the first and last days of the study. A significant group by pre-post session MANOVA, $F\ (4,21) = 2.86$; $p < 0.05$, was obtained on the short term measures (STAI-anxiety, POMS-mood, VITAS-back and leg pain) and a significant group by days MANOVA, $F\ (11,14) = 4.45$; $p < 0.01$, was obtained on the longer-term measures (CES-D depression, Perinatal Anxieties, Maternal-Fetal Attachment Scale and Sleep diary). ANOVAs were subsequently conducted to determine specific effects, and interaction effects were tested by Bonferroni *t*-tests.

Immediate effects pre-post treatment measures

State Anxiety Scale (STAI)

A group by day by pre-post session interaction effect, $F\ (1,24) = 11.43$, $p < 0.01$, and subsequent *t*-tests revealed decreased anxiety after the first

session for the massage therapy and relaxation groups and after the last session for the massage therapy group (see Table 2).

Profile of Mood States (POMS)

A group by day by pre-post session interaction effect, F (1,24) = 5.78, $p < 0.05$, followed by t-tests revealed that only the massage therapy group improved in mood from pre- to post-session on the first and last days of the study (see Table 2).

VITAS (visual analog scale)

A group by pre-post session interaction effect was obtained on the VITAS-back pain scale, F (1,24) = 7.67, $p < 0.01$, a main effect of pre-post session, F (1,24) = 14.96, $p < 0.001$, and a group by day interaction effect was found for the VITAS-leg pain scale, F (1,24) = 4.17, $p < 0.05$. Bonferroni t-tests revealed decreased back pain for the massage therapy group immediately following the first and last sessions and lessened leg pain for both groups from pre-to-post session on both days (see Table 2).

Longer term effects first/last days measures

CES-D (Depression Scale)

The groups did not change on depression scale scores (see Table 3).

Perinatal Anxieties and Attitudes Scale

A significant group by days interaction effect on the perinatal worries subscale, F (1,24) = 29.23, $p < 0.001$, and subsequent t-tests revealed that the massage therapy group reported having a more optimal pregnancy on the last day of the study and reported less worries about caring for their newborn whereas the relaxation therapy group reported more worries by the last day of the study (see Table 3).

Maternal Fetal Attachment Scale

A significant group by days interaction for the maternal social support subscale (F (1,24) = 5.84, $p < 0.05$) and subsequent t-tests revealed better scores for the massage therapy group by the last day on perceived social support and worse scores for the relaxation group by the last day.

Sleep Scale

A significant group by days interaction effect (F (1,24) = 6.22, $p < 0.05$) on the sleep disturbance subscale and subsequent t-tests revealed less disrupted sleep by the last day of the study for the massage therapy group and an increase in supplemental daytime sleep for the relaxation group (see Table 3).

Urine

Because the data for the biochemical measures were not normally distributed, nonparametric Wilcoxon matched pairs signed ranks tests were conducted. The analyses revealed a significant decrease in norepinephrine, $Z = 3.04$, $p < 0.01$, and an increase in dopamine for the massage therapy group, $Z = 3.18$, $p < 0.01$, from the first to the last day. The relaxation group also showed increased dopamine levels by the last day, $Z = 2.10$, $p < 0.05$ (see Table 3).

Obstetric and Postnatal Complications

Because these scales yielded only summary scores, two-sample t-tests were conducted. These revealed that the massage therapy group had fewer obstetric complications, t (24) = 2.32, $p < 0.05$ and their newborns had fewer postnatal complications, t (24) = 3.90, $p < 0.05$. Subsequent χ^2 analyses revealed that women in the massage group had less premature births, $X^2 = 3.88$, $p < 0.05$, and their infants required less ventilatory assistance, $X^2 = 4.94$, $p < 0.05$ (see Table 3).

DISCUSSION

The massaged pregnant women's improvement in mood at both assessment periods is consistent with the stress reduction data of this study and others in the literature[16,20] and provides additional support for the psychotherapeutic benefits of massage during pregnancy. The massage therapy and relaxation groups in this study reported lower anxiety levels after their first session. However, only the massage therapy group's scores decreased on the last day of the study. Also, they were the only group to show reduced stress hormones

Table 2 Means for the massage therapy and relaxation groups for short-term measures (pre-post session)

	Massage		*Relaxation*	
	First day Pre/Post	*Last day Pre/Post*	*First day Pre/Post*	*Last day Pre/Post*
Short-term measures				
STAI (anxiety)	36.1/23.6‡	33.9/28.0†	38.8/22.8**	32.8/30.0
POMS (mood)	1.9/0.6*	2.7/0.9†	1.8/1.3	2.8/3.0
VTAS				
Back pain	4.6/2.2†	3.8/2.1**	3.4/3.3	3.2/3.5
Leg pain	2.0/1.2*	1.5/0.9*	2.3/1.4*	3.8/2.6*

*p=0.05; **p=0.01; †p=0.005; ‡p=0.001; for adjacent numbers: lower scores are optimal

Table 3 Means for massage for therapy and relaxation group for longer-term measures (first/last day)

Variables	*Massage First/last day*	*Relaxation First/last day*
Longer-term measures		
CES-D (depression)	12.7/10.6	13.5/10.2
Perinatal Anxieties[1]		
Pregnancy	69.6/77.4**	63.8/67.3
Labor and Birth	79.5/85.4	71.0/63.4
Worries and Post Birth	75.3/90.6‡	82.2/71.5**
Pregnancy Onset	80.1/83.8	77.1/63.3
Maternal Fetal Attachment[1]		
Feelings	3.1/3.3	3.4/3.3
Fetal Attachment	2.3/2.6	2.6/2.5
Social Support	2.9/3.3*	3.1/2.7*
Sleep Scale		
Disturbance	49.4/38.0*	50.4/50.2
Effectiveness[1]	48.3/51.9	47.3/48.5
Supplementary	25.6/23.3	19.5/33.4*

*p=0.05; **p=0.01; †p=0.005; ‡p=0.001; indicates significance level for adjacent numbers.
[1]Higher scores are optimal

(norepinephrine). These data concur with other findings of reduced anxiety and stress-related hormones following massage therapy[17,37].

The decrease in norepinephrine levels over the 5 week period would also be expected to positively affect pregnancy outcomes and may have contributed to the lower obstetric (e.g., less prematurity) and postnatal complication scores (e.g., less ventilatory assistance provided to infants) for the massage therapy group. Massage and relaxation therapies may reduce disturbed sleep patterns in fetuses[4] and negative pregnancy outcomes (including low birth rate, preeclampsia, prematurity, and intrapartum complications) via reduced anxiety and stress hormones[10].

Reduced back and leg pain following massage therapy could have contributed to the improved mood and overall lowered anxiety levels[1]. Lower pain levels have also resulted from massage therapy for adults with pain syndromes including fibromyalgia[37], migraine[18], and chronic lower back pain[38] and for women receiving massage during labor[16].

Back and leg pain relief from massage therapy may have also contributed to the massaged women's report of less sleep disturbance or less sleep disturbance may have contributed to less pain as was suggested by Sunshine, Field, and colleagues[37] (1997) in a recent massage therapy study on fibromyalgia. The authors of that study speculated that less sleep may have led to higher substance P levels and in turn to greater pain. The relaxation therapy in the present study, in contrast to the massage therapy group, reported an increase in supplemental sleep, suggesting the need for additional naps, perhaps because they continued to experience sleep disturbance during their pregnancy as they reported in their sleep diaries.

The increased dopamine levels for both groups is difficult to interpret. Low-dose dopamine has been shown to improve renal function[39] and urine output in postpartum women with high blood pressure[40], suggesting that increased dopamine may have some clinical significance for specific pregnancy problems, such as preeclampsia.

Overall, the present findings suggest that massage therapy is effective for reducing pregnant women's anxiety levels, stress hormones, sleep disturbance and back pain and for lessening obstetric and postnatal complications. Further research is needed to explore the underlying mechanisms for these changes.

Table 4 Means for massage therapy and relaxation group for biochemical measures (first-last day), obstetric and postnatal complications

	Massage		*Relaxation*	
Variables	*First/last day*	*Wilcoxon p-value*	*First/last day*	*Wilcoxon p-value*
Biochemical				
Cortisol	91/185	0.60	199/204	0.67
Norepinephrine	42/28	0.01	35/43	0.21
Epinephrine	8/6	0.20	3/4	0.44
Dopamine	300/399	0.01	370/444	0.05
Serotonin	4448/4651	0.81	3697/3995	0.16
Post-birth complications[1]				
Obstetric	115.4		95.8	0.05*
preclampsia	11%		22%	0.20†
prematurity	0%		33%	0.05†
Postnatal	136.2		115.3	0.05*
ventilatory	0%		33%	0.05†

[1]Higher scores are optimal, *t-test; †χ^2 tests

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