

# Collected Scientific Research Relating to the Use of Osteopathy with Biochemical markers

## Important:

1) Osteopathy involves helping people's own self-healing abilities to work better, rather than focussing primarily on particular conditions.

2) Each person is different, and osteopathy treats them differently.

Therefore people respond to osteopathic treatment in different ways. Treatments that work for one person cannot be guaranteed to work for another person in the same way. The fact that there is scientific research supporting a treatment in a group of people does not mean that it will always work in the same way (which is probably true of all research).

A number of things make research into osteopathy challenging. These include the two aspects of osteopathy mentioned above, and also the lack of major commercial interests to provide funding in expectation of financial returns. At the same time, there is an emerging body of research demonstrating the usefulness of osteopathic treatment.

Please note: there is room for debate about the classifications used for these studies. Please let John Smartt know if you believe that any of these classifications are incorrect.

# These studies are from peer-reviewed journals

Number  
of studies:  
15

## Clinically and statistically significant results

Number  
of studies:  
14

## Systematic reviews

Number of studies: 1

Kovanur-Sampath K, Mani R, Cotter J, Gisselman AS, Tumilty S 2017 **Changes in biochemical markers following spinal manipulation-a systematic review and meta-analysis.**

Musculoskelet Sci Pract Jun;29:120-131 <https://www.ncbi.nlm.nih.gov/pubmed/28399479>

"The aim of this meta-analysis was to determine the effectiveness of spinal manipulation in influencing various biochemical markers in healthy and or symptomatic population. Electronic databases (n = 10) were searched (from inception till September 2016) and eight trials (325 participants) that met the inclusion criteria were included in the meta-analysis. Two authors independently extracted and assessed the risk of bias in included studies. Standardised mean differences for outcome measures were used to calculate effect sizes. The Grading of Recommendations, Assessment, Development and Evaluation (GRADE) tool was used for assessing the quality of the body of evidence for each outcome of interest. There was moderate quality evidence that spinal manipulation influenced biochemical markers. There was moderate quality evidence of significant difference that spinal manipulation is better (SMD -0.46, 95% CI -0.93 to 0) than control in eliciting changes in cortisol levels immediately after intervention. There was also a low quality evidence that spinal manipulation is better than control at post-intervention in increasing substance-P (SMD -0.48, 95% CI -0.87 to -0.1), neurotensin (SMD -1.8, 95% CI -2.56 to -1.04) and oxytocin levels (SMD -2.61, 95% CI -3.5 to -1.72). However, low quality evidence indicated that spinal manipulation did not influence epinephrine (SMD 0.1, 95% CI -0.56 to 0.75) or nor-epinephrine levels (SMD -0.06, 95% CI -0.71 to 0.6). The current review found that spinal manipulation can increase substance-p, neurotensin, oxytocin and interleukin levels and may influence cortisol levels post-intervention. However, future trials targeting symptomatic populations are required to understand the clinical importance of such changes."

Kovanur Sampath K, Mani R, Cotter JD, Tumilty S 2015 **Measureable changes in the neuro-endocrinal mechanism following spinal manipulation**. Med Hypotheses Dec;85(6):819-24  
<http://www.medical-hypotheses.com/article/S0306-9877%2815%2900374-6/abstract#>.  
*VkwyqRZHQQM.facebook*

"The autonomic nervous system and the hypothalamic–pituitary–adrenal axis have been shown to be dysfunctional in a number of chronic pain disorders. Spinal manipulation is a therapeutic technique used by manual therapists, which may have widespread neuro-physiological effects. The autonomic nervous system has been implicated to modulate these effects. A theory is proposed that spinal manipulation has the potential to be used as a tool in restoring the autonomic nervous system balance. Further, it is also hypothesised that through its anatomical and physiological connections, the autonomic nervous system activity following a thoracic spinal manipulation may have an effect on the hypothalamic–pituitary–adrenal axis and therefore pain and healing via modulation of endocrine and physiological processes. To substantiate our hypothesis we provide evidence from manual therapy studies, basic science and animal studies. According to the proposed theory, there will be measurable changes in the neuro-endocrinal mechanisms following a thoracic spinal manipulation. This has far-reaching implications for manual therapy practice and research and in the integration of spinal manipulation in the treatment of a wide array of disorders."

Fornari M, Carnevali L, Sgoifo A 2017 **Single Osteopathic Manipulative Therapy Session Dampens Acute Autonomic and Neuroendocrine Responses to Mental Stress in Healthy Male Participants.** *J Am Osteopath Assoc* Sep 1;117(9):559-567 <http://jaoa.org/article.aspx?articleid=2652668>

"Context: The efficacy of osteopathic manipulative therapy (OMTh; manipulative care provided by foreign-trained osteopaths) is supported by observational data and patient feedback, but there is still a need for objective, quantitative biomarkers that allow measurement of the underlying mechanisms. No study exploring the protective potential of OMTh for mental stress has been published, to the authors' knowledge.

Objectives: To explore the modulating effect of OMTh on autonomic neural regulation of the heart and verify its ability to influence the activity of the hypothalamic-pituitary-adrenocortical axis.

Methods: Healthy young adult men who had never received OMTh were exposed to either a brief protocol using craniosacral techniques or sham therapy (control) involving the same anatomical areas. A laboratory stress episode consisting of a 5-minute arithmetic task participants were required to perform in front of a committee preceded the therapy sessions. Continuous electrocardiograph recordings were done before, during, and after the stress episode. Heart rate and frequency-domain parameters of heart rate variability (specifically, high-frequency component power in normalized units and the ratio of low-frequency to high-frequency power) were measured to quantify the activity of the parasympathetic nervous system and the state of sympathovagal balance at the level of the heart, respectively. Saliva samples were also collected at points throughout the study to determine cortisol levels.

Results: Osteopathic manipulative therapy reduced the overall chronotropic effect of the stressor ( $t=-2.9$ ,  $P<.05$ ) and counteracted the vagal withdrawal and the shift of autonomic balance toward sympathetic prevalence ( $t=-2.8$ ,  $P<.05$ ) that were observed in control participants. Moreover, OMTh participants had a much lower overall cortisol level during the mental stressor compared with control participants ( $t=-2.3$ ,  $P<.05$ ). Participants in the OMTh group did not show the statistically significant reduction in the amplitude of the cortisol awakening response observed in their control counterparts after the stress episode (control:  $t=2.7$ ,  $P<.05$ ; OMT:  $P=.83$ ).

Conclusion: The application of a single OMTh session to healthy participants induced a faster recovery of heart rate and sympathovagal balance after an acute mental stressor by substantially dampening parasympathetic withdrawal and sympathetic prevalence. The OMTh session also prevented the typical increase in cortisol levels observed immediately after a brief mental challenge."

Bakar Y, Coknaz H, Karlı Ü, Semsek Ö, Serin E, Pala ÖO 2015 **Effect of manual lymph drainage on removal of blood lactate after submaximal exercise.** *J Phys Ther Sci* Nov;27(11):3387-91 <http://www.ncbi.nlm.nih.gov/pubmed/26696704>

"[Purpose] It has been well-established that exercise-induced muscle damage occurs following intense exercise. Massage is commonly used to manage muscle damage resulting from exercise. However the effect of massage after exercise is still not clear. The purpose of this study was to examine the effect of manual lymph drainage on muscle damage and on the removal of blood lactate following submaximal exercise (SE), as part of a solution to the challenging problem in sports medicine of muscular recovery after exercise. [Subjects and Methods] Eighteen healthy male students, with moderate exercise training, were randomly assigned to either receive manual lymph drainage (MLD) or serve as controls. Both groups were subjected to a graded exercise test, performed on a treadmill ergometer, to determine each subject's individual anaerobic threshold (IAT). Seven days later, all subjects were made to run for 30 minutes on the same treadmill ergometer, at a running speed equivalent to the IAT. One group received MLD treatment, while the control subjects received no treatment. [Results] Following an increase immediately after exercise, lactic acid (LA) and lactate dehydrogenase (LDH) serum levels dropped rapidly and significantly at the end of MLD application and two

hours after SE in the subjects receiving MLD. The course of creatine kinase (CK) and myoglobin levels was comparable, and with myoglobin showing a significant difference at 2 h after SE, and CK at 24 h after SE. [Conclusion] Manual lymph drainage after SE correlated with a more rapid fall in LA and of the muscular enzymes of LDH, CK and myoglobin, and may have resulted in an improvement in the regenerative processes elicited by structural damage to the muscle cells"

Henderson AT, Fisher JF, Blair J, Shea C, Li TS, Bridges KG. 2010 **Effects of rib raising on the autonomic nervous system: a pilot study using noninvasive biomarkers.** J Am Osteopath Assoc Jun;110(6):324-30 <http://www.ncbi.nlm.nih.gov/pubmed/20606239>

"Changes in salivary biomarkers after rib raising were investigated using a pretest-posttest, placebo-controlled design. Healthy adult participants were recruited and randomly assigned to rib raising or placebo (light touch) groups. All participants provided baseline saliva samples and samples immediately and 10 minutes after receiving the rib raising or placebo procedure. Salivary flow rate, alpha-amylase activity, and cortisol levels were measured for each sample." "Twenty-three participants were recruited, of whom 14 completed the study (7 in each group). Subjects who received rib raising had a statistically significant decrease in alpha-amylase activity both immediately after ( $P=.014$ ) and 10 minutes after ( $P=.008$ ) the procedure. A statistically significant change in alpha-amylase activity was not seen in the placebo group at either time point. Changes in salivary cortisol levels and flow rate were not statistically significant in either group."

"The results of the present pilot study suggest that SNS activity may decrease immediately after rib raising, but the hypothalamic-pituitary-adrenal axis and parasympathetic activity are not altered by this technique. Salivary alpha-amylase may be a useful biomarker for investigating manipulative treatments targeting the SNS. Additional studies with a greater number of subjects are needed to expand on these results."

Stringer J, Swindell R, Dennis M 2008 **Massage in patients undergoing intensive chemotherapy reduces serum cortisol and prolactin.** Psychooncology Oct;17(10):1024-31 <https://www.ncbi.nlm.nih.gov/pubmed/18300336>

**OBJECTIVE:**

The objective is to identify whether single 20 min massage sessions were safe and effective in reducing stress levels of isolated haematological oncology patients.

**DESIGN:**

Based on a randomised controlled trial, 39 patients were randomised to aromatherapy, massage or rest (control) arm.

**MEASURES:**

The measures were serum cortisol and prolactin levels, quality of life (EORTC QLQ-C30) and semi-structured interviews. Primary outcome measure was the fall in serum cortisol levels.

**RESULTS:**

A significant difference was seen between arms in cortisol ( $P=0.002$ ) and prolactin ( $p=0.031$ ) levels from baseline to 30 min post-session. Aromatherapy and massage arms showed a significantly greater drop in cortisol than the rest arm. Only the massage arm had a significantly greater reduction in prolactin than the rest arm. The EORTC QLQ-C30 showed a significant reduction in 'need for rest' for patients in both experimental arms compared with the control arm, whereas the semi-structured interviews identified a universal feeling of relaxation in patients in the experimental arms.

**CONCLUSION:**

This pilot study demonstrated that in isolated haematological oncology patients, a significant reduction in cortisol could be safely achieved through massage, with associated improvement in psychological well-being. The implications are discussed."

Degenhardt BF, Darmani NA, Johnson JC, Towns LC, Rhodes DC, Trinh C, McClanahan B, DiMarzo V. 2007 **Role of osteopathic manipulative treatment in altering pain biomarkers: a pilot study.** J Am Osteopath Assoc Sep;107(9):387-400 <http://www.ncbi.nlm.nih.gov/pubmed/17908831>

"In a prospective, blinded assessment, blood was collected from 20 subjects (10 with chronic low back pain [LBP], 10 controls without chronic LBP) for 5 consecutive days. On day 4, OMT was administered to subjects 1 hour before blood collection. Blood was analyzed for levels of beta-endorphin (betaE), serotonin (5-hydroxytryptamine [5-HT]), 5-hydroxyindoleacetic acid (5-HIAA), anandamide (arachidonoyl ethanolamide [AEA]), and N-palmitoylethanolamide (PEA). A daily questionnaire was used to monitor confounding factors, including pain and stress levels, sleep patterns, and substance use."

"Increases from baseline in betaE and PEA levels and a decrease in AEA levels occurred immediately posttreatment. At 24 hours posttreatment, similar biomarker changes from baseline were observed. A decrease in stress occurred from baseline to day 5. The change in PEA from baseline to 24 hours posttreatment correlated with the corresponding changes in stress. Subgroup analysis showed that subjects with chronic LBP had significantly reduced 5-HIAA levels at 30 minutes posttreatment ( $P=.05$ ) and 5-HT levels at 24 hours posttreatment ( $P=.02$ ) when compared with baseline concentrations. The increase in PEA in subjects with chronic LBP at 30 minutes posttreatment was two times greater than the increase in control subjects."

"Concentrations of several circulatory pain biomarkers were altered after OMT. The degree and duration of these changes were greater in subjects with chronic LBP than in control subjects without the disorder."

Schillinger A, Koenig D, Haefele C, Vogt S, Heinrich L, Aust A, Birnesser H, Schmid A 2006 **Effect of manual lymph drainage on the course of serum levels of muscle enzymes after treadmill exercise.** Am J Phys Med Rehabil Jun;85(6):516-20 <http://www.ncbi.nlm.nih.gov/pubmed/16715021>

**"OBJECTIVE:**

Improving muscular recovery after exercise is an important topic in sports medicine. The aim of the present study was to evaluate the effect of manual lymph drainage on the course of serum levels of muscle enzymes after an extended treadmill exercise.

**DESIGN:**

Fourteen recreational athletes (seven women, seven men) were included in the study. The participants underwent a graded exercise test on a treadmill ergometer to determine the individual anaerobic threshold (IAT). Seven days after the graded exercise test, all subjects performed 30 mins of treadmill exercise at an intensity equivalent to IAT. The subjects were randomized into two groups of seven persons. One group was treated with manual lymph drainage (ML), whereas the control group (CG) received no treatment after the endurance exercise at IAT level.

**RESULTS:**

After an increase immediately after exercise, a fast decrease in lactate dehydrogenase (LDH) and in aspartate aminotransferase (AST) concentration was observed, with significantly lower values for LDH after 48 hrs in the subjects having received lymph drainage treatment. The course of creatine kinase (CK) levels was comparable, but did not reach significance."

Hernandez-Reif M, Ironson G, Field T, Hurley J, Katz G, Diego M, Weiss S, Fletcher MA, Schanberg S, Kuhn C, Burman I. 2004 **Breast cancer patients have improved immune and neuroendocrine functions following massage therapy.** J Psychosom Res Jul;57(1):45-52 <https://www.ncbi.nlm.nih.gov/pubmed/15256294>

**"OBJECTIVES:**

Women with breast cancer are at risk for elevated depression, anxiety, and decreased natural killer (NK) cell number. Stress has been linked to increased tumor development by decreasing NK cell activity. The objectives of this study included examining massage therapy for women with breast cancer for (1) improving mood and biological measures associated with mood enhancement (serotonin, dopamine), (2) reducing stress and stress hormone levels, and (3) boosting immune measures.

**METHODS:**

Thirty-four women (M age=53) diagnosed with Stage 1 or 2 breast cancer were randomly assigned postsurgery to a massage therapy group (to receive 30-min massages three times per

week for 5 weeks) or a control group. The massage consisted of stroking, squeezing, and stretching techniques to the head, arms, legs/feet, and back. On the first and last day of the study, the women were assessed on (1) immediate effects measures of anxiety, depressed mood, and vigor and (2) longer term effects on depression, anxiety and hostility, functioning, body image, and avoidant versus intrusive coping style, in addition to urinary catecholamines (norepinephrine, epinephrine, and dopamine) and serotonin levels. A subset of 27 women (n=15 massage) had blood drawn to assay immune measures.

**RESULTS:**

The immediate massage therapy effects included reduced anxiety, depressed mood, and anger. The longer term massage effects included reduced depression and hostility and increased urinary dopamine, serotonin values, NK cell number, and lymphocytes.

**CONCLUSIONS:**

Women with Stage 1 and 2 breast cancer may benefit from thrice-weekly massage therapy for reducing depressed mood, anxiety, and anger and for enhancing dopamine, serotonin, and NK cell number and lymphocytes."

Shor-Posner G, Miguez M, Hernandez-Reif M, Perez-Then E, Fletcher MA 2004 **Massage treatment in HIV-1 infected Dominican children: a preliminary report on the efficacy of massage therapy to preserve the immune system in children without antiretroviral medication** Journal of Alternative & Complementary Medicine Dec;10(6):1093-1095 <https://www.ncbi.nlm.nih.gov/pubmed/15674006>

"Objectives: More than 1.4 million children are living with HIV and global access to antiretrovirals is not yet readily available. Massage therapy, which has been shown to improve immune function in HIV+ adults and adolescents, may provide an important complementary treatment to boost immune status in young children living with HIV disease, especially those without access to antiretroviral medications. No studies have been conducted, however, that specifically target massage therapy to enhance immune function in HIV+ children.

Design: Clinical trial with eligible, consented HIV+ children randomized to receive either massage therapy or a friendly visit (controls).

Settings/Location: CENISMI/Robert Reid Cabral Hospital, Santo Domingo, Dominican Republic.

Subjects: HIV+ children ages 2–8 years.

Intervention: Massage therapy sessions (20 minutes, twice weekly, for 12 weeks), conducted by trained nurses, following a structured protocol of moderate pressure stroking and kneading of muscles, using a nonscented oil. The friendly visit control group, (reading, talking, playing quiet games), met with the nurse twice weekly for 12 weeks.

Outcome Measures: At the initial evaluation, and following the 12-week intervention, blood was drawn to determine absolute helper (CD4/T4) and suppressor (CD8/T8) counts.

Results: Children in the control arm had a greater relative risk of CD4 count decline (>20%) than massagetreated children (RR = 5.7, p = 0.03). Lymphocyte loss was also more extensive in the controls (p < 0.02), and more of the control group than the massage group lost >50 CD8 lymphocytes (p = 0.03).

Conclusions: The efficacy of massage therapy in maintaining immunocompetence may offer a viable alternative to the thousands of children worldwide without antiretroviral access."

Joan G. Turner DSN RN CIC1, Ann J. Clark PhD RN2, Dorothy K. Gauthier PhD RN3, Monica Williams BA MA4 1998 **The effect of therapeutic touch on pain and anxiety in burn patients** Journal of Advanced Nursing Jul;28(1):10-20 <https://www.ncbi.nlm.nih.gov/pubmed/9687125>

The purpose of this single-blinded randomized clinical trial was to determine whether therapeutic touch (TT) versus sham TT could produce greater pain relief as an adjunct to

narcotic analgesia, a greater reduction in anxiety, and alterations in plasma T-lymphocyte concentrations among burn patients. Therapeutic touch is an intervention in which human energies are therapeutically manipulated, a practice conceptually supported by Rogers' (1970) theory of unitary human beings. Data were collected at a university burn centre in the south-eastern United States. The subjects were 99 men and women between the ages of 15 and 68 hospitalized for severe burns, and they received either TT or sham TT once a day for 5 days. Baseline data were collected on day 1, data were collected before and after treatment on day 3, and post-intervention data were collected on day 6. Instruments included the McGill Pain Questionnaire, Visual Analogue Scales for Pain, Anxiety and Satisfaction with Therapy, and an Effectiveness of Therapy Form. Blood was drawn on days 1 and 6 for lymphocyte subset analysis. Medication usage for pain in mean morphine equivalents, and mean doses per day of sleep, anxiety and antidepressant medications were recorded. Subjects who received TT reported significantly greater reduction in pain on the McGill Pain Questionnaire Pain Rating Index and Number of Words Chosen and greater reduction in anxiety on the Visual Analogue Scale for Anxiety than did those who received sham TT. Lymphocyte subset analyses on blood from 11 subjects showed a decreasing total CD8+lymphocyte concentration for the TT group. There was no statistically significant difference between groups on medication usage.

## Non-human studies

Number of studies: 3

Castillo R, Schander A, Hodge LM 2018 **Lymphatic Pump Treatment Mobilizes Bioactive Lymph That Suppresses Macrophage Activity In Vitro** J Am Osteopath Assoc July 2018, Vol. 118, 455-461 <http://jaoa.org/article.aspx?articleid=2686417>

"Context: By promoting the recirculation of tissue fluid, the lymphatic system preserves tissue health, aids in the absorption of gastrointestinal lipids, and supports immune surveillance. Failure of the lymphatic system has been implicated in the pathogenesis of several infectious and inflammatory diseases. Thus, interventions that enhance lymphatic circulation, such as osteopathic lymphatic pump treatment (LPT), should aid in the management of these diseases.

Objective: To determine whether thoracic duct lymph (TDL) mobilized during LPT would alter the function of macrophages in vitro.

Methods: The thoracic ducts of 6 mongrel dogs were cannulated, and TDL samples were collected before (baseline), during, and 10 minutes after LPT. Thoracic duct lymph flow was measured, and TDL samples were analyzed for protein concentration. To measure the effect of TDL on macrophage activity, RAW 264.7 macrophages were cultured for 1 hour to acclimate. After 1 hour, cell-free TDL collected at baseline, during LPT, and after TDL was added at 5% total volume per well and co-cultured with or without 500 ng per well of lipopolysaccharide (LPS) for 24 hours. As a control for the addition of 5% TDL, macrophages were cultured with phosphate-buffered saline (PBS) at 5% total volume per well and co-cultured with or without 500 ng per well of LPS for 24 hours. After culture, cell-free supernatants were assayed for nitrite (NO<sub>2</sub><sup>-</sup>), tumor necrosis factor  $\alpha$  (TNF- $\alpha$ ) and interleukin 10 (IL-10). Macrophage viability was measured using flow cytometry.

Results: Lymphatic pump treatment significantly increased TDL flow and the flux of protein in TDL (P<.001). After culture, macrophage viability was approximately 90%. During activation with LPS, baseline TDL, TDL during LPT, and TDL after LPT significantly decreased the production of NO<sub>2</sub><sup>-</sup>, TNF- $\alpha$ , and IL-10 by macrophages (P<.05). However, no significant differences were found in viability or the production of NO<sub>2</sub><sup>-</sup>, TNF- $\alpha$ , or IL-10 between macrophages cultured with LPS plus TDL taken before, during, and after LPT (P>.05).

Conclusion: The redistribution of protective lymph during LPT may provide scientific rationale for the clinical use of LPT to reduce inflammation and manage edema."

Zein-Hammoud M, Standley PR. 2015 **Modeled Osteopathic Manipulative Treatments: A Review of Their in Vitro Effects on Fibroblast Tissue Preparations.** J Am Osteopath Assoc Aug 1;115(8):490-502 <https://jaoa.org/article.aspx?articleid=2422100>

"Although modeled RMS [repetitive motion strain] produced a delayed inflammatory response and reduction in cellular proliferation, both modeled CS [counter strain] and MFR [myofascial release] reversed those effects."

"Herein, we have shown proof of concept that both clinical CS and clinical MFR may equivalently reverse RMS injury in patients in manners that affect cytokine and NO signaling as well as cellular proliferation."

"Further, these findings suggest that dose-dependent and prophylactic MFR may potentially regulate inflammation and wound healing responses in patients."

"If clinically translatable, our results suggest that although RMS would clinically reduce the ability to regenerate and repair muscles, MFR would enhance these effects. "

Huff JB, Schander A, Downey F, Hodge LM 2010 **Lymphatic Pump Treatment Augments Lymphatic Flux of Lymphocytes in Rats** *Lymphat Res Biol* Dec; 8(4): 183–187 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3025762/>

#### "Background

Lymphatic pump techniques (LPT) are used by osteopathic practitioners for the treatment of edema and infection; however, the mechanisms by which LPT enhances the lymphatic and immune systems are poorly understood.

#### Methods and Results

To measure the effect of LPT on the rat, the cisterna chyli (CC) of 10 rats were cannulated and lymph was collected during 4 min of 1) pre-LPT baseline, 2) 4 min LPT, and 3) 10 min post-LPT recovery. LPT increased significantly ( $p < 0.05$ ) lymph flow from a baseline of  $24 \pm 5 \mu\text{l}/\text{min}$  to  $89 \pm 30 \mu\text{l}/\text{min}$ . The baseline CC lymphocyte flux was  $0.65 \pm 0.21 \times 10^6$  lymphocytes/min, and LPT increased CC lymphocyte flux to  $6.10 \pm 0.99 \times 10^6$  lymphocytes/min ( $p < 0.01$ ). LPT had no preferential effect on any lymphocyte population, since total lymphocytes, CD4+ T cells, CD8+ T cells, and B cell numbers were similarly increased. To determine if LPT mobilized gut-associated lymphocytes into the CC lymph, gut-associated lymphocytes in the CC lymph were identified by staining CC lymphocytes for the gut homing receptor integrin  $\alpha 4\beta 7$ . LPT significantly increased ( $p < 0.01$ ) the flux of  $\alpha 4\beta 7$  positive CC lymphocytes from a baseline of  $0.70 \pm 0.03 \times 10^5$  lymphocytes/min to  $6.50 \pm 0.10 \times 10^5$  lymphocytes/min during LPT. Finally, lymphocyte flux during recovery was similar to baseline, indicating the effects of LPT are transient.

#### Conclusions

Collectively, these results suggest that LPT may enhance immune surveillance by increasing the numbers of lymphocytes released in to lymphatic circulation, especially from the gut associated lymphoid tissue. The rat provides a useful model to further investigate the effect of LPT on the lymphatic and immune systems."

**Mixed results (significant for some outcomes, not others)**

Number  
of studies:  
1

Noll DR. 2013 **The short-term effect of a lymphatic pump protocol on blood cell counts in nursing home residents with limited mobility: a pilot study.** J Am Osteopath Assoc Jul;113 (7):520-8 <http://www.ncbi.nlm.nih.gov/pubmed/23843375>

**"CONTEXT:**

Lymphatic pump techniques have the potential to alter blood cell counts and thus enhance immune function in elderly adults with diminished mobility.

**OBJECTIVE:**

To test whether an osteopathic manipulative treatment (OMT) protocol designed to enhance immune function will have an effect on lymphocyte and lymphocyte subset counts compared with a sham control group.

**DESIGN:**

The study design was a single-session, randomized, controlled clinical trial comparing a standardized lymphatic pump protocol with a light-touch protocol. Participants were assigned to 1 of 2 groups by using a 1:1 allocation ratio.

**SETTING:**

The study was conducted in 2 rural long-term care facilities in Missouri.

**PARTICIPANTS:**

Residents in the long-term care facilities who were aged 60 years or older and who were confined to a bed or wheelchair for most of their waking hours. Twenty residents were recruited to participate in the study, and 10 were randomly assigned to each group.

**INTERVENTIONS:**

Baseline blood samples were obtained. Then each patient received a 6-minute study protocol treatment. Thirty minutes after completion, posttreatment blood samples were obtained. The OMT protocol consisted of 3 osteopathic techniques: myofascial release to the thoracic inlet, the splenic pump, and the pedal lymphatic pump. The light touch protocol was applied to the same body areas as the OMT protocol for 6 minutes.

**OUTCOME MEASURES:**

A pretreatment and posttreatment lymphocyte subset panel, complete blood cell count, and automated white blood cell count differential was obtained from each participant.

**RESULTS:**

There was a statistically significant between-group difference in mean change for platelet counts: counts in the OMT group decreased by a mean (standard deviation) of 15,400 (7947) platelets per microliter and the light touch group increased by 4,700 (17,857) platelets per microliter ( $P=.004$ ). The between-group differences for the mean (standard deviation) absolute lymphocyte cell count, red blood cell count, hemoglobin level, and hematocrit measures all decreased, but the changes were not statistically significant relative to the control group.

**CONCLUSION:**

The OMT protocol used in this pilot study modestly reduced platelet counts in nursing home residents with limited mobility."