UNC PEMBROKE | MAYNOR HONORS COLLEGE

Evaluating Complementary Therapies and Alternative Medicine for Pain Management in Adults with Non-Specific Low Back Pain

Senior Project

In partial fulfillment of the requirements for
The Esther G. Maynor Honors College
University of North Carolina at Pembroke

By

Amanda Stoddard
Department of Nursing
December 5, 2019

_____

Amanda Stoddard 12/5/19
Honors College Scholar

_____

William J. Puentes PhD, RN, FAAN 12/5/19
Faculty Mentor

_____

Joshua K. Busman 12/5/19
Senior Project Coordinator

Acknowledgements

I would like to thank Dr. Puentes for guiding me through this project. I would also like to thank Dr. Decker and Dr. Busman from the Honors College for making this project possible.

Abstract

Pain is a subjective experience that is influenced by a multitude of biological, cultural, and psychological factors. Chronic low back pain is a major source of pain and disability for many individuals and its prevalence is rising. A variety of increasingly popular complementary and alternative therapies, as outlined by the National Center for Complementary and Integrative Health (NCCIH), will be summarized and evaluated for their effectiveness and accessibility for people experiencing chronic low back pain. The most popular therapies discussed were chosen using the NCCIH webpages titled, “Mind and Body Approaches for Chronic Pain: What the Science Says” and “Herbal medicine for low back pain”, this page has a link to a 2006 Cochrane study. Natural products include Harpagophytum procumbens (Devil’s Claw), Salix alba (White Willow Bark), and Capsicum frutescens. Mind and body therapies include spinal manipulation, yoga, and acupuncture. In 2007, 17.1% of people used complementary and alternative therapies to try and treat their low back pain (Barnes et al., 2008). As there is limited evidence and research to objectively prove its safety and effectiveness, there is a need for further research regarding the safety and effectiveness of these complementary therapies.

Complementary Therapies and Alternative Medicine for Pain Management in Adults with Non-Specific Low Back Pain

Introduction

Pain is a subjective experience that is influenced by a multitude of biological, cultural, and psychological factors. Pain can also influence an individual's level of functionality and cognition, thus influencing quality of life. The International Association for the Study of Pain (IASP) defines pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (Merskey & Bogduk, 1994). Pain is commonly classified into the categories acute and chronic. These classifications are based on the duration of pain. Acute pain usually occurs suddenly, lasts a short amount of time ranging from hours to weeks, has a predictable course of healing, and results from tissue damage or trauma. Chronic pain relates to unpredictable pain intensity that has lasted for longer than 3 months and the cause of this pain may or may not be known. Chronic pain may often result from an accident or trauma that initially caused acute pain, but can persist to chronic pain that is difficult to manage.

Chronic low back pain is a major source of pain and disability for many individuals and its prevalence is rising. It affects one's ability to perform activities of daily living, develop relationships, and maintain work relationships and performance. Chronic low back pain is defined as burning, stabbing or throbbing pain in the lumbar region lasting longer than three months and excludes pain related to an underlying condition. Traditional pain management in western culture for chronic low back pain relies on the use of pharmacologic treatment to include opioids and non-opioid analgesics. However, in light of the opioid crisis healthcare providers and patients have been seeking out alternative and complementary therapies in an attempt to help

promote pain relief in their clients with methods that decrease the overall amount of opioids prescribed and used.

Complementary therapy is defined as using an unconventional health practice in conjunction with and to support conventional medical practices prescribed by a practitioner. Alternative medicine is defined as any therapy that is not within the realm of traditional medical practices in the United States.

This paper discusses a variety increasingly popular complementary and alternative therapies, as outlined by the National Center for Complementary and Integrative Health, to summarize and evaluate their effectiveness and accessibility for people experiencing chronic low back pain.

Causes of Low Back Pain

Chronic low back pain can originate from a wide range of sources. Causes of low back pain that can be changed by the individual are known as modifiable factors. These include level of activity, diet, weight, and lifestyle. Obesity contributes to chronic low back pain as it puts excess pressure on the musculoskeletal system. A poor diet not only contributes to obesity and excess weight gain, but it also relates to vitamin deficiencies and weakened bone density. Work conditions and poor body mechanics adopted by the individual can lead to low back pain. Poor physical fitness puts the individual at risk for back pain as the back and abdominal muscles are weak and unable to support excess activity. Individuals cannot change non-modifiable factors. These factors include age, genetics, and events that are out of the individuals control like accidents or trauma.

Methods

Studies were chosen using online databases through the University of North Carolina at Pembroke's online resource library, PRIMO. The two categories of therapy were identified from the National Center for Complementary and Integrative Health (NCCIH). The most popular therapies from each category were chosen and researched based on their effectiveness for chronic non-specific low back pain. The most popular therapies discussed were chosen using the NCCIH webpages titled, "Mind and Body Approaches for Chronic Pain: What the Science Says" and "Herbal medicine for low back pain", this page has a link to a 2006 Cochrane study outlining natural products that show potential for aiding people with low back pain. Mind and body practices that will be evaluated include spinal manipulation, acupuncture, and yoga. Natural products that will be reviewed include Harpagophytum procumbens (Devils Claw), Salix alba (White Willow Bark) and Capsicum frutescens. The primary databases used included CINAHL-Complete, Nursing & Allied Health Database, and PubMed.

Discussion

With any form of treatment for pain the goal is the same: to reduce or eliminate pain in a way that promotes quality of life and improves function. Typically, low back pain is managed with pharmaceuticals that have the potential to cause negative side effects. These analgesics fail to specifically target the problem area and may only temporarily improve the patient's physical condition (Lim et al., 2018).

The National Center for Complementary and Integrative Health (NCCIH) has categorized complementary health therapies into two groups: the use of natural products and mind and body practices.

Natural Products

Natural products refer to substances such as vitamins, minerals, and probiotics that are derived from marine life, bacteria, fungi, and plants (Barnes et al., 2008). The use of natural products is becoming more popular among American adults (Barnes et al., 2008). As these products are readily accessible to the public for use, it is crucial that individuals who take natural products seek advice from a medical professional as potential interactions with drugs and other dietary supplements could occur. In regards to low back pain, there are a variety of natural products that have demonstrated some effectiveness in pain management; however more research is needed to determine the effects and safety of these products when used on a long-term basis.

Capsicum frutescens. Capsicum frutescens is a type of chili pepper. Capsaicin is the active chemical in capsicum (Capsicum, n.d.). This compound is extracted from chili peppers and produces a burning sensation over the area in which it is applied. Capsaicin is used topically in the forms of plasters, gel, and creams. Topical use is associated with very mild reactions and common side effects include irritation and burning of the skin and itching. Related to these side effects, patients need education regarding application of the cream. Individuals should be encouraged to wear gloves and wash their hands immediately after application in order to prevent transfer and cause irritation to the eyes and mouth. Patients should also refrain from exposure to additional heat sources, like electric pads or exposure to sun, over the application area as this can potentiate the burning sensations.

This treatment is available both over-the-counter and as a prescription. Stronger strengths can only be prescribed by a physician, but the over the counter preparations gives great accessibility to those who may not be able to visit a doctor or who wish to try and self-manage pain.

Capsaicin is used as a temporary form of analgesia for people experiencing chronic pain. The

justification for using capsaicin is “derived from the results of three randomized placebo controlled trials, one of acute mechanical back pain and two of chronic nonspecific back pain” (Hebert, 2014, pg. 219). In regards to the studies that focused on chronic low back pain, when compared to the placebo groups, capsaicin produced a statistically significant outcome and participants reported 60% pain reduction when compared to the control (Hebert, 2014). Capsaicin offers potential as both an adjuvant therapy and as a stand-alone therapy depending on the overall severity of the chronic low back pain. Many studies are ambiguous regarding whether or not capsicum serves best as an adjuvant or stand-alone therapy related to low back pain. It is important to point out that individuals will have independent results, but this therapy may work as an effective alternative to non-steroidal anti-inflammatory drugs (NSAIDs) (Frerick et al., 2003; Blahova et al., 2016).

Salix Alba. Salix Alba, or white willow bark extract (WWB), has been used historically for its anti-inflammatory properties. WWB acts similarly to aspirin as both have salicylate properties; therefore patients on aspirin regimens, taking NSAIDS, or any other anticoagulant medications should consult their doctors before concurrent use. This supplement has relativity few side effects. Side effects are uncommon and mild compared to aspirin and NSAIDs and include upset stomach, ulcers, and gastric bleeding. WWB offer a potential alternative to patients who cannot tolerate the negative side effects associated with NSAIDs (Chrubasik et al., 2000). Similar to other over-the-counter anti-inflammatory medications, such as aspirin or ibuprofen, the supplement white willow bark is available over the counter at comparable pricing.

In a double blind study, 39% of patients receiving 240 mg of WWB extract reported complete reduction of pain and had not used additional medication to relieve pain for at least five days, compared to 21% in the low dose (120mg) over four weeks (Chrubasik et al., 2000). There

are very few studies that examine the effectiveness of WWB in the long term. A 2013 study followed patients taking 240 mg of WWB for six months. While patients were allowed to take opioid and NSAIDs during this time frame if needed, pain scores had decrease by approximately 45% from the baseline (Uehleke et al., 2013). Future research is justified to further support the external validity of these studies.

Harpagophytum procumbens. Harpagophytum procumbens, also known as devil's claw, is an herbal supplement used in a wide variety of conditions, including chronic low back pain. Research has suggested that devil's claw may work as effectively as taking a non-steroidal anti-inflammatory drugs (Chrubasik et al., 2002). It can be purchased over the counter at a variety of health and grocery stores, thus making it accessible to those who may lack access to affordable health care or desire to add a complementary therapy to their prescribed regimen. Devil's claw should be taken under medical supervision as there are several major drug interactions including anti-coagulants and anti-platelets, diabetes management medications, antacids, and other medications that are metabolized by the liver. Patients with ulcers, gallstones or diabetes mellitus should avoid this supplement as the main side effect is related to gastrointestinal disturbances (Ghasemian et al., 2016). Common side effects associated with the supplement include diarrhea, nausea, vomiting, and loss of appetite ("Devil's Claw", n.d.). As the long-term effects remain unknown it is only recommended that individuals take it for up to a year.

Devil's claw has been shown to have anti-inflammatory properties. Trials that compared devil's claw to common medications used to treat low back pain suggested that 50-100mg of the supplement daily produced the greatest pain management (Otlean et al., 2014). An 8-week study using devil's claw demonstrated that in people with non-specific low back pain the overall use of NSAIDs dropped and that the percentage of self-reported pain scores rated between zero and one

increased by nine percent (Chrubasik et al., 2002). This suggests that devil's claw may be an effective complementary method for decreasing pain and decreasing the overall amount of pharmacological therapy used. In a study that followed patients using devil's claw as a part of their treatment regimen for over a year, 75% of patients reported that their pain had improved and self reported the improvement as "good" or "very good" and the overall use of NSAIDs during that year was low (Chrubasik et al., 2005). This study however, did not have a control group and relied on diary entries from participants to outline if any additional analgesia was used and relied on participants to be truthful in their recordings.

The few studies associated with the effectiveness of devil's claw are often low quality. Further study is required to establish the efficacy of this supplement, but there are a variety of other studies related to other conditions, such as rheumatoid arthritis, that support its anti-inflammatory and analgesia properties.

Mind and Body Practices

Mind and body practices refer to a large range of therapeutic non-pharmacological methods that are typically performed by trained professionals and practitioners. Many of these practices are deeply rooted in a wide range of cultures. Health insurance companies may not cover these therapies and access may be problematic for those who are unable to pay for these services out of pocket. Inability to pay for these services may prevent patients from seeking follow-up care and thus decreasing the effectiveness of therapies and increasing the likelihood of the return or worsening of pain. An overall benefit to mind and body therapy is that it can be a stand-alone treatment or can be combined with a physician prescribed pain management regimen with relatively few concerns or adverse effects.

Yoga. Traditionally, yoga involves the mind, body and spirit. There is a strong focus on breathing, meditation, and holding physical poses ("Yoga for health", n.d.). Yoga has wide range of health benefits varying from lowering blood pressure to aiding in digestion. It has also been found to reduce anxiety and depression. Anxiety and depression are known to negatively impact the way in which an individual perceives and manages their pain. Yoga has a strong focus on breathing and can reverse the effects that contribute to low back pain. Talsama (2016) relates that hyperventilation, whether it be from anxiety or other causes, leads to muscle tension in the back from thoracic breathing. Yoga aims to control breathing patterns and reduce tension in the body and mind.

Yoga may be more beneficial to people with chronic low back pain who are hesitant to engage in activities that may increase their pain. Yoga is a "gradual, guided exposure to movement and activity" (Holtzman et al., 2013, pg. 271). As with any form of exercise, there is the potential for injury and soreness in targeted muscle groups; therefore, it is important that the individual use caution and correct form when undertaking this exercise. For beginners, especially those using it for healing and therapeutic properties, it is best undertaken under the supervision of a certified instructor.

There are barriers to yoga therapy for low back pain. Yoga classes are typical utilized by white individuals from higher socioeconomic classes and those who have some college education (Saper et al., 2013). The cost of these classes range from $15 to $20 (Saper et al., 2013). While weekly and biweekly classes have shown to be effective for reduction pain, the cost is not plausible for many individuals. Other barriers to yoga include cost, time, lack of knowledge about access to classes, and general stereotypes regarding athletic ability (Brems et al., 2015). Individuals who cannot afford or do not have access to yoga classes are able to use online

resources to perform yoga on their own; however, those who do not have a knowledge base of yoga and do not perform it under direct supervision of an instructor are more likely to experience negative adverse effects such as pulled muscles, soreness, and injury.

Yoga, when compared to just implementing an educational program, has been shown in 16-weeks to more significantly reduce pain, disability, and the use of pain medication (Williams et al., 2005). Both groups found improvement in their physical status, but at a three month follow up, the yoga group was found to still retain the results (Williams et al., 2005). This suggests that yoga could potentially have long lasting improvements on a person's functionality and pain. A 2013 meta-analysis examined randomized controlled trials and supported the assertion that yoga has the ability to decrease reports of pain (Holtzman et al., 2013). There are many types of yoga that vary in pace, difficulty, and focuses on different aspects of the mind and body, but the meta-analysis by Holtzman et al (2013) also supports that the general focus of "strength, flexibility, breathing and focused awareness is more important" than the specific yoga routine (Holtzman et al., 2013, pg. 270). This meta-analysis also included studies that monitored the long-term low back pain relief at three and six months. Results from the majority of the studies included suggest that there are potential long-term benefits regarding low back pain management (Holtzman et al., 2013). Yoga relieves pain as it focuses on isometric contraction, stretching tight muscle groups, and strengthening of core and back muscles (Talsama, 2016). These factors will improve the individual's ability to move without pain and bear weight.

Spinal manipulation. Spinal manipulation refers to controlled force applied to the spine by a licensed practitioner, such as a chiropractor or physical therapist, with the goal of decreasing the overall pain and disability experienced by the patient. Spinal manipulation as a complementary treatment modality is growing in popularity among practitioners and individuals alike. It offers

an opportunity to decrease low back pain and disability, especially if combined with medications such as NSAIDs or acetaminophen.

Many insurance companies including Medicare and Medicaid cover chiropractor services, giving greater accessibility to a wide variety of people with varying socioeconomic backgrounds. Medicare patients receiving spinal manipulation as an alternative therapy demonstrated lower health care costs and a shorter duration of chronic back pain (Weeks et al., 2016). Patients using spinal manipulation as a complementary therapy to their physician's pain management regimen had the next lowest incidence of cost and pain relief (Weeks et al., 2016). Spinal manipulation has the ability to decrease overall health care costs**.** For those that do not have insurance the average cost for a session is 65 dollars, with prices ranging from 30 to 200 dollars (Briones, 2017).

There are relatively few negative side effects of spinal manipulation when performed correctly by a professional. The most common side effects of spinal manipulation range from stiffness to soreness in the targeted muscle group ("Spinal Manipulation", 2019). However, while extremely rare, complications can range from fracture to disk herniation (Herbert et al, 2016). The rate of serious complications is approximately ten complications per one million chiropractic manipulations (Skappak, 2018). The interdisciplinary team needs to thoroughly assess the client for any risk factors such as bone deformities, osteoporosis, or underlying disorders before clearing the client for spinal manipulation in order to reduce adverse outcomes.

Treatment of low back pain with spinal manipulation is shown in many studies to decrease reactions to painful stimuli after treatment. Spinal manipulation increases mobility and decrease intensity of pain immediately in patients receiving manipulations in the bilateral pelvis region, middle thoracic region, and bilateral cervical region at the C3 level (Fernades et al., 2016).

Similarly, manipulation on the lumbar and thoracic regions demonstrated a 30% improvement in self- reported pain (Vilas Boas et al, 2016). The greatest response and greatest reduction in chronic low back pain related to spinal manipulation was found to be 12 visits in 12 weeks (Haas et al., 2014). There was no significant benefit noted with additional visits. The overall cost of spinal manipulation, especially if covered by insurance and effective for the patient, may be less expensive than long term and repeated physician and specialty visits. Multiple studies support that spinal manipulation decreases overall disability related to low back pain in patients. Spinal manipulation with thrust movements was shown in a 2018 meta-analysis to reduce the instances of disability in patients and have a "small to moderate reduction in pain intensity" when compared to interventions involving exercise (Coutler et al., 2018, pg. 12).

Overall, people who use spinal manipulation to relieve their low back pain tend to find high rates of satisfaction with the therapy, regardless of overall pain relief ("Spinal Manipulation", 2019). Yet those that initially seek chiropractic care over care from a medical doctor tend to see greater improvement in the overall pain scale rating (Houwelling et al., 2015). Spinal manipulation can easily be used as an alternative intervention or in conjunction with a medication or other therapeutic regimens

Acupuncture. Acupuncture is deeply rooted within the Chinese and Asian culture and medicine. There has been a renewed interest in acupuncture within western culture and the use of it as a complementary and alternative therapy for low back pain has increased significantly.

Acupuncture involves inserting needles to stimulate areas of the body. Medically, it is still unknown exactly how acupuncture works on the human body to relieve pain. In the context of traditional Chinese medicine, acupuncture is explained as the release of Qi energy into the 12 meridians of the body, which stimulates the body's healing process (Hutchinson et al., 2012).

Acupuncture is considered to be relatively safe when performed by a professionals, such as doctors, physiotherapists, and certified acupuncturists, and when using sterile needles. Side effects include are mild and include soreness and possible bleeding and bruising where the needles are placed.

Acupuncture is most commonly used in combination with other treatments. If used as a complementary therapy for chronic low back pain in conjunction with care such as medication, physiotherapy, exercises, and education it is considered to be cost effective (Wonderling, 2006; Grace et al., 2018). As an independent therapy, acupuncture is related to an increase in health care costs.

There is uncertainty related to whether or not pain relief associated with acupuncture is a placebo effect related to the patient's belief in the treatment. A 2012 meta-analysis supports the assertion that acupuncture is not completely a placebo, and while outcomes are associated with individual perception, groups that received correctly placed acupuncture experienced the greatest pain relief, though differences were modest (Vickers et al., 2012). The results were the same related to chronic low back pain specifically. There are improvements in both functionality and pain when this therapy is used as an adjunct for low back pain (Liu et al., 2015).

Pharmacology and Low Back Pain

According to clinical guidelines published by the American College of Physicians, pharmacological treatment should be used only after non-pharmacological treatment has proven ineffective, yet pain is almost always initially treated using some form of physician prescribed medications (Chou et al., 2007). There are a wide variety of pharmacological treatment options for patients experiencing low back pain. The first line treatment for low back pain includes NSAIDs and acetaminophen. These medications do not create dependence in users, nor do they

build up tolerance and require increased dosage. However, NSAIDs may not be as effective for patients who have pain that has been present longer than three months. When combined with complementary therapy, however, effectiveness increases (Chrubisiak et al., 2000). In light of the opioid crisis, the least problematic treatment modality should be used in order to prevent addiction. Opioids have been frequently prescribed for chronic low back pain. Opioids are commonly associated with tolerance, dependence, and serious adverse effects affecting breathing and level of consciousness. The pain relief of both NSAIDs and opioids are similar for patients with chronic low back pain, thus opioids should not be used as a first line treatment related to adverse effects and risk for tolerance and dependency (White et al., 2011).

Conclusion

Overall, complementary and alternative therapies are increasing in popularity. In an age in which access to health care in America is expensive and limited, individuals in need of care are more likely to attempt to use complementary or alternative medicines first (Barnes et al, 2008). This not only acknowledges issues within America's health care system, but also identifies the need for education regarding the safety, accessibility, and effectiveness of these therapies.

Chronic low back pain is one of the most common health afflictions and sources of pain, with many current medications not completely managing the pain effectively or posing great risks to patients. Complementary and alternative therapies offer an opportunity to increase pain relief and decrease the amount of analgesia medications taken.

In 2007, 17.1% of people used complementary and alternative therapies to try and treat their low back pain (Barnes et al., 2008). Contemporary use is rising dramatically. As there is limited evidence and research to objectively prove its safety and effectiveness, there is a need for

further research regarding these therapies and whether or not they should be implemented into everyday practice.

References

Barnes, P. M., Bloom, B., & Nahin, R. L. (2008). Complementary and Alternative Medicine Use Among Adults and Children: United States, 2007. *National Health Statistics Report*, (12). doi: 10.1037/e623942009-001

Bialosky, J. E., George, S. Z., Horn, M. E., Price, D. D., Staud, R., & Robinson, M. E. (2014). Spinal manipulative therapy-specific changes in pain sensitivity in individuals with low back pain (NCT01168999). *The journal of pain : official journal of the American Pain Society*, *15*(2), 136–148. doi:10.1016/j.jpain.2013.10.005

Blahova, Z., Holm, J. C., Weiser, T., Richter, E., Trampisch, M., & Akarachkova, E. (2016). Nicoboxil/nonivamide cream effectively and safely reduces acute nonspecific low back pain – a randomized, placebo-controlled trial. *Journal of Pain Research, 9*, 1221-1230. doi: http://dx.doi.org/10.2147/JPR.S118329

Brems, C., Justice, L., Sulenes, K., & Girasa, L., Ray, J., Davis, M., Freitas, J., & Shean, M., Colgan, D. (2015). Improving access to yoga: Barriers to and motivators for practice among health professions students. *Advances in mind-body medicine. 29. 6-13.*

Briones, D. (2017). Cost of Chiropractic Care - Treatment Costs. Retrieved from https://www.docshop.com/education/chiropractic/cost.

Chou, R., & Huffman, L. H. (2007). Nonpharmacologic Therapies for Acute and Chronic Low Back Pain: A Review of the Evidence for an American Pain Society/American College of Physicians Clinical Practice Guideline. *Annals of Internal Medicine*, *147*(7), 492. doi: 10.7326/0003-4819-147-7-200710020-00007

Chrubasik, S., Eisenberg, E., Balan, E., Weinberger, T., Luzzati, R., & Conradt, C. (2000). Treatment of low back pain exacerbations with willow bark extract: a randomized

double-blind study. *The American Journal of Medicine*, *109*(1), 9–14. doi: 10.1016/s0002-9343(00)00442-3

Chrubasik, S., Thanner, J., Kunzel, O., Conradt, C., & Pollak, A. B. (2002). Comparison of outcome measures during treatment with the proprietary harpagophytum extract doloteffin (registered) in patients with pain in the lower back, knee or hip. *Phytomedicine, 9*(3), 181-94.

Chrubasik, S., Chrubasik, C., Künzel, O., & Black, A. (2007). Patient-perceived benefit during one year of treatment with Doloteffin®. *Phytomedicine*, *14*(6), 371–376. doi: 10.1016/j.phymed.2007.04.011

Coulter, I. D., Crawford, C., Hurwitz, E. L., Vernon, H., Khorsan, R., Suttorp Booth, M., & Herman, P. M.(2018). Manipulation and mobilization for treating chronic low back pain: a systematic review and meta-analysis. *The spine journal : official journal of the North American Spine Society*, *18*(5), 866–879. doi:10.1016/j.spinee.2018.01.013

Devil's Claw: MedlinePlus Supplements. (n.d.). Retrieved from https://medlineplus.gov/druginfo/natural/984.html.

Devil's claw (2015). Johns Creek: Ebix Inc. Retrieved from https://login.proxy181.nclive.org/login?url=https://search.proquest.com/docview/2088910798?accountid=13153

Frerick, H., Kuhn, U., Schmidt, U., Kuhlmann, M., & Bredehorst, A. (2003). Capsicum Pain Plaster in Chronic Non-specific Low Back Pain. *Arzneimittelforschung, 51*(11). doi: 10.1055/s-0031-1300134

Ghasemian, M., Owlia, S., & Owlia, M. B. (2016). Review of Anti-Inflammatory Herbal Medicines. *Advances in pharmacological sciences*, *2016*. doi:10.1155/2016/9130979

Grace, S., Reilly , W., de Permentier, P., Vlass, A., & Zhang, D. (2018). The cost-effectiveness of natural medicine: An literature review. *Journal of the Australian Traditional-Medicine Society*, *24*(1).

Haas, M., Vavrek, D., Peterson, D., Polissar, N., & Neradilek, M. B. (2014). Dose-response and efficacy of spinal manipulation for care of chronic low back pain: a randomized controlled trial. *The spine journal : official journal of the North American Spine Society*, *14*(7), 1106–1116. doi:10.1016/j.spinee.2013.07.468

Hebert, J. J., Stomski, N. J., French, S. D., & Rubinstein, S. M. (2015). Serious Adverse Events and Spinal Manipulative Therapy of the Low Back Region: A Systematic Review of Cases. *Journal of Manipulative and Physiological Therapeutics*, *38*(9), 677–691. doi: 10.1016/j.jmpt.2013.05.009

Holtzman, S., & Beggs, R. (2013). Yoga for chronic low back pain: Analysis of randomized controlled trials. *Pain Research and Management*, *18*(5), 267–272 doi.org/10.1155/2013/105919

Houweling, T. A., Braga, A. V., Hausheer, T., Vogelsang, M., Peterson, C., & Humphreys, B. K. (2015). First-Contact Care With a Medical vs Chiropractic Provider After Consultation With a Swiss Telemedicine Provider: Comparison of Outcomes, Patient Satisfaction, and Health Care Costs in Spinal, Hip, and Shoulder Pain Patients. *Journal of Manipulative and Physiological Therapeutics*, *38*(7), 477–483. doi: 10.1016/j.jmpt.2015.06.015

Hutchinson, A. J. P., Ball, S., Andrews, J. C. H., & Jones, G. G. (2012). The effectiveness of acupuncture in treating chronic non-specific low back pain: a systematic review of the

literature. *Journal of Orthopaedic Surgery and Research*, *7*(1), 36. doi: 10.1186/1749-799x-7-36

Lim, T. K., Ma, Y., Berger, F., & Litscher, G. (2018). Acupuncture and Neural Mechanism in the Management of Low Back Pain-An Update. *Medicines (Basel, Switzerland)*, *5*(3), 63. doi:10.3390/medicines5030063

Liu, L., Skinner, M., Mcdonough, S., Mabire, L., & Baxter, G. D. (2015). Acupuncture for Low Back Pain: An Overview of Systematic Reviews. *Evidence-Based Complementary and Alternative Medicine*, *2015*, 1–18. doi: 10.1155/2015/328196

Merskey, H., & Bogduk, N. (Eds.). (1994). Part III: Pain Terms: A Current List with Definitions and Notes on Usage. In *Classifications of Chronic Pain: Descriptions of Chronic Pain Syndromes and Definitions of Pain Terms, Second Edition*.

Retrieved July, 2019, from https://www.iasp-pain.org/PublicationsNews/Content.aspx?ItemNumber=1673&navItemNumber=677

Oltean H., Robbins C., van Tulder M., Berman B., Bombardier C., Gagnier J.. (2014) Herbal medicine for low-back pain. *Cochrane Database of Systematic Reviews*

DOI: 10.1002/14651858.CD004504.pub4 – not APA

Saper, R., Boah, A., Keosaian, J., Cerrada, C., Weinberg, J., & Sherman, K. (2013). Comparing Once- versus Twice-Weekly Yoga Classes for Chronic Low Back Pain in Predominantly Low Income Minorities: A Randomized Dosing Trial. *Evidence-Based Complementary and Alternative Medicine*. doi: 10.1155/2013/658030

Spinal Manipulation: What You Need To Know. (2019).

Retrieved from https://nccih.nih.gov/health/pain/spinemanipulation.htm.

Talsama, S. (2016). Yoga for Low Back Pain & Rehabilitation [Power Point Slides].

Retrieved from: https://cdn.ymaws.com/www.aoasm.org/resource/resmgr/OMED2016/PierceTalsma_YogaForLBP.pdf

Tekur, P., Nagarathna, R., Chametcha, S., Hankey, A., & Nagendra, H. (2012). A comprehensive yoga programs improves pain, anxiety and depression in chronic low back pain patients more than exercise: An RCT. *Complementary Therapies in Medicine*, *20*(3), 107–118. https://doi.org/10.1016/j.ctim.2011.12.009

Uehleke, B., Müller, J., Stange, R., Kelber, O., & Melzer, J. (2013). Willow bark extract STW 33-I in the long-term treatment of outpatients with rheumatic pain mainly osteoarthritis or back pain. *Phytomedicine*, *20*(11), 980–984. https://doi.org/10.1016/j.phymed.2013.03.023

Weeks, W. B., Leininger, B., Whedon, J. M., Lurie, J. D., Tosteson, T. D., Swenson, R., Goertz, C. M. (2016). The Association Between Use of Chiropractic Care and Costs of Care Among Older Medicare Patients With Chronic Low Back Pain and Multiple Comorbidities. *Journal of manipulative and physiological therapeutics*, *39*(2), 63–75.e2. doi:10.1016/j.jmpt.2016.01.006

White, A. P., Arnold, P. M., Norvell, D. C., Ecker, E., & Fehlings, M. G. (2011). Pharmacologic Management of Chronic Low Back Pain. *Spine*, *36*. doi: 10.1097/brs.0b013e31822f178f

Williams, K. A., Petronis, J., Smith, D., Goodrich, D., Wu, J., Ravi, N., … Steinberg, L. (2005). Effect of Iyengar yoga therapy for chronic low back pain. *Pain*, *115*(1), 107–117. doi: 10.1016/j.pain.2005.02.016

Wonderling D. (2006). Acupuncture in mainstream health care. *BMJ (Clinical research ed.)*,*333*(7569), 611–612. doi:10.1136/bmj.38954.627361.BE

Vickers, A. J., Cronin, A. M., Maschino, A. C., Lewith, G., Macpherson, H., Foster, N. E. Collaboration, F. T. A. T. (2012). Acupuncture for Chronic Pain. *Archives of Internal Medicine*, *172*(19), 1444. doi: 10.1001/archinternmed.2012.3654

Yoga for health: MedlinePlus Medical Encyclopedia. (n.d.). Retrieved from https://medlineplus.gov/ency/patientinstructions/000876.htm.