

ASTHMA

BACKGROUND

Asthma is a common chronic respiratory disorder known to involve complex inflammatory processes and a significant genetic predisposition. Symptoms include recurrent episodes of wheezing, cough, chest tightness, and breathlessness. Chronic inflammation leads to airway hyper-responsiveness. Triggers for acute symptoms are variable, as is the severity of disease and the individual's response to treatment. Research shows that in those with asthma, allergens tend to increase the activity of type 2 helper cells, which are highly proinflammatory.[1] Proactive self-care approaches, such as movement, nutrition, and stress management, not to mention paying attention to environmental influences, can play an important role in controlling asthma by raising the threshold at which an individual experiences symptoms. Empowerment of patients in managing their disease, while appropriately using pharmaceuticals as well, is crucial. The following focuses on treating asthma using a Whole Health approach.

MOVING THE BODY

AEROBIC EXERCISE

Although exercise is a known trigger for asthma symptoms in many patients, a number of studies have shown improved asthma control in those who exercise regularly.[1] Exercise regimens can be undertaken safely, with improvement in several measures of health and no significant worsening of asthma symptoms.[2,3] There is no evidence that one form of exercise is superior to another.[1] Any exercise regimen to which an individual can commit can be supported, from walking to dancing to fitness classes and from martial arts to training for competitive races.

YOGA

Multiple human studies report benefits of yoga when added to other, more conventional, treatments for mild-to-moderate asthma.[4] Positive outcomes associated with yoga practices include decreased medication use, lower anxiety, reduced airway hyper-responsiveness, improved aspects of quality of life, and significantly improved lung function. In these studies, both groups continued their regular pharmacologic treatments through the duration of the investigation.[1] While there was some concern for methodological flaws in many of the studies, a 2016 Cochrane review of 15 studies with 1,048 participants showed that yoga likely improves quality of life and asthma symptoms.[5] There are many different forms of yoga but one of the most important factors is having an instructor who can provide appropriate modifications of the various postures and poses that honor the comfort and ability of the individual.

SURROUNDINGS

A significant number of factors in the physical environment can exacerbate asthma symptoms and worsen disease control. These can include:

- Allergens such as house dust mites, pets, and pollens
- Colds and viral infections
- Cockroaches
- Medications and foods
- Air pollutants such as tobacco smoke, wood smoke, chemicals, and ozone
- Occupational exposure to allergens, vapors, dust, gases, and fumes
- Strong odors and sprays such as perfumes, household cleaners, cooking fumes, paints, and varnishes[1]

Tips to limit exposure to some of these triggers include the following (to level possible and as determined by the known triggers of the individual):[6]

- Enclose pillows and mattresses in airtight polyurethane covers.
- Use fiberfill products instead of down or foam pillows.
- Remove carpeting (hardwood or linoleum floors are better) and curtains.
- Wash sheets and stuffed toys (for pediatric patients) frequently in hot water.
- Clean bedrooms frequently with a vacuum that has a high-efficiency particulate air (HEPA) filter.
- Maintain a high level of cleanliness so as to remove cockroaches and their feces.
- Eliminate exposure to tobacco smoke.
- Remove pets from the home.

If triggers are not known, working with an allergy specialist may result in identifying problematic allergens/triggers. In some cases, immunotherapy may be an option and can result in significantly better asthma control.[7]

A number of common chemicals, such as perfluorinated compounds (PFCs) and dioxins are nearly omnipresent and have been found to negatively impact immune function. They potentially lead to immune system imbalances, predisposing people to higher levels of autoimmune diseases, including allergies and asthma.[8,9] Becoming more aware of the number of chemicals to which we are exposed and their potential for negative impact on our health can be overwhelming. When working with individuals on this aspect of environmental health, it is prudent to focus on what *can* be controlled—i.e., limiting exposures based on guidance from resources such as the website of the [Environmental Working Group](#) and supporting the body's detoxification mechanisms by optimizing overall wellness.

There has been some evidence that repair of mold-damage in home, work, and school environments can improve asthma disease control and decrease other respiratory symptoms.[10] Studies have investigated removal of asthma-inducing triggers in the workplace versus reduction of exposures; the former was more effective for reducing

symptoms and improving lung function, but it also seemed to be associated with an increased risk of unemployment.[11]

In addition to physical environments, social environments play a role in asthma disease control. Asthma symptoms are more likely to flare in the face of psychosocial stress, such as low socioeconomic status and urban living. Immune changes with stress-induced flares may actually make an individual less responsive to the corticosteroids used to treat exacerbations.[12]

FOOD AND DRINK

ANTI-INFLAMMATORY LIFESTYLE

A very large component of the pathophysiology of asthma is inflammation within the airways. Nutrition may be the single most important factor in optimizing immune function and controlling inflammation in the body, because it can have a positive or negative impact depending on dietary patterns. Diets rich in antioxidants seem to improve Asthma Control Test™ (ACT) scores and quality of life. Evidence is mixed, but there does not seem to be strong evidence to support the use of supplementation with vitamin C, vitamin E, selenium, or magnesium in asthmatic patients.[13,14] Increased fruit and vegetable intake, along with greater dietary intake of vitamin C, D, and E, seems to have a beneficial impact on asthma, especially in children. [15]

The balance between omega-6 and omega-3 polyunsaturated fatty acids (PUFAs) in our diets is of particular importance in controlling inflammation. The same enzymes in the body metabolize both, but the omega-6 fats promote inflammation while omega-3 fats promote wound healing and resolution of inflammation.[16] The ideal ratio of intake of omega-6 and omega-3 fats seems to be around 2:1, but the standard American diet contains a ratio closer to 10:1 to 25:1, strongly tipping the balance toward inflammation. In general, an anti-inflammatory diet includes the following[17]:

- Cold water fish, flax, and nuts
- A wide variety of fruits and vegetables of various deep colors
- Whole grains
- Anti-inflammatory spices such as turmeric, ginger, rosemary, oregano, and cayenne

An anti-inflammatory diet avoids or limits[17]:

- Foods high in trans- and omega-6 fats (processed and red meats, dairy, and partially hydrogenated oils, as well as corn, cottonseed, grapeseed, peanut, and soy oils)
- Refined carbohydrates, such as white breads, instant or white rice, rice and corn cereals, crackers, cookies, and cake)
- Soda and juices

While data is limited on the benefits of supplementation with the fatty acids for asthma, small studies in asthmatics have shown the following[13]:

- Conjugated linoleic acid can support weight loss
- Gamma-linolenic acid plus eicosapentaenoic acid can improve asthma control and quality of life
- Perilla oil (oil derived from perilla seeds) can improve pulmonary function

A trial of a fish oil supplement of approximately 1,000-1,500 mg daily is reasonable for asthmatics. The benefit may not be seen for a few months.[1] More information is available in [“The Anti-Inflammatory Lifestyle”](#) handout.

GUT HEALTH

Gut health deserves attention with regard to immunity as well. The gut is the major interface between the external world and the body’s internal environment. It has evolved over time to house an important mix of healthy bacteria. This intestinal microenvironment is suspected to have a huge regulatory impact on our immune function, not only protecting us from illness-causing microbes but also preventing the overactivity of the immune system seen in autoimmune diseases such as food allergies. What it takes to keep the gut healthy may vary based on the individual. However, a few key components seem common to everyone:

1. Avoidance of the excess inflammation which can be caused by foods and medications that irritate the gut, as well as by one’s lacking effective mechanisms to deal with life’s stresses
2. A healthy mucus layer which lubricates the intestinal lining and feeds the healthy bacteria that reside there
3. An appropriate mix of healthy bacteria

Foods to consider eliminating on a trial basis include dairy (milk, cheese, and sour cream), eggs, nuts, shellfish, wheat (gluten), corn, preservatives, and food additives (like dyes and fillers). More information is available in the [“Promoting a Healthy Microbiome with Food and Probiotics”](#) Whole Health tool.

VITAMIN C

Several studies have shown Vitamin C has a role in improving lung function in asthma. Vitamin C-rich fruits, including grapefruit, kiwi, sweet orange, and others should be consumed no less than one to two times per week.[18] While, as mentioned above, overall data to date does not necessarily support vitamin C supplementation in patients with asthma, it has been studied for many inflammatory lung conditions with promising results. Its antioxidant activity seems to have a role preventing and treating pneumonia,[19] and it is one of the few interventions that has potential benefit patients critically ill with lower respiratory complications of COVID-19.[20] Given its immune modulating and antioxidant properties, a trial of oral vitamin C is a low-risk intervention for those with suboptimally controlled asthma. A dose of 250-500 mg, 1-2 times per day is reasonable.

VITAMIN D

In children, lower serum vitamin D levels are associated with increased airway reactivity, more-frequent hospitalizations, higher use of anti-inflammatory drugs, and recent upper respiratory tract infection. It is reasonable to consider at least taking the daily recommended dose of 400 International Units (IUs) daily for children younger than 4 years of age, and 600 IUs daily for adults. There are many complementary medicine practitioners who would suggest taking very high doses of vitamin D; however, some sources report that excess vitamin D may cause abnormally high levels of calcium in the blood that may damage bones, soft tissues, and kidneys.[1]

Although data has been mixed, Vitamin D supplementation seems to decrease the number of asthma exacerbations that require systemic corticosteroids. This impact may be more significant in those with baseline 25-OH-vitamin D levels of 25 nmol/L (10ng/mL) or less.[21,22] Dosing in studies has varied, but once a vitamin D level has been repleted to the normal range 2,000 IUs daily of vitamin D3 is reasonable.

CAFFEINE

Caffeine appears to improve airway function for 2-4 hours after consumption in people with asthma.[23] Sources such as coffee, green tea, and black tea can be considered, but they should not replace use of short-acting beta agonist inhalers unless symptoms are quite mild.

WEIGHT MANAGEMENT

Obesity is related to worse outcomes in asthma patients. A loss of as little as 7.5% body weight in obese asthmatics improves disease control and quality of life.[13]

SPIRIT & SOUL

Each individual's spirituality is as unique as he or she is. Spiritual practices can involve prayer, energy work (such as Reiki, Healing Touch, etc.), time in nature, meditation, journaling, and artistic outlets. There was one small study of "hands-on" healing in adults with asthma that found a reduction in medication use[1]; this offers a glimpse into how our connection with things outside of ourselves can affect our health. Taking a spiritual history to help determine the locus of the individual's sense of meaning and purpose and help us formulate health plans that are more personal to that human being. For more information, refer to the "[Spirit and Soul](#)" Whole Health overview.

POWER OF THE MIND

Mind-body medicine looks not only at how negative mind-states and stress can be detrimental to health, but also at how to empower individuals to activate their own healing responses. It is thought that working in this realm can settle down the inflammatory

processes that can be triggered by the autonomic nervous system through emotions. Anxiety and panic seem to be higher during the presence of asthma symptoms, and it is possible that symptoms can be reduced if an individual can use mind-body techniques to manage their emotions.

It has also been shown that stress can influence the immune response. Stress may promote higher sympathetic activity, increase the production of IgE immunoglobulins, and cause a shift in T-helper cells toward a more autoimmune profile. Stress also seems to promote airway inflammation without causing overt symptoms.[1] There are a number of mind-body interventions that have been studied in regard to asthma, including Psychotherapy, Relaxation Therapy, Hypnotherapy, Guided Imagery, journaling, and breathing exercises.

MINDFULNESS

Mindfulness-based stress reduction (MBSR) may produce lasting and clinically significant improvements in quality of life and stress levels of asthmatic individuals with persistent and more moderate/severe disease. Cognitive Behavioral Therapy (CBT) has shown to improve health-related quality of life and asthma symptoms, in addition to increasing medication adherence, knowledge, and self-efficacy as they relate to asthma self-care.[24,25]

PSYCHOTHERAPY

There have been several studies which showed slight improvement in wheezing and thoracic gas volume in children who experienced Family Psychotherapy.[26] A 2015 review found that CBT improved health-related quality of life and asthma symptoms and increased adherence, knowledge, attitude toward asthma, and self-efficacy.[24]

RELAXATION THERAPY

Relaxation techniques that foster a sense of calm and decrease tension seem to decrease asthma symptoms as well as positively impact anger expression, anxiety, and depression. There is some evidence that these techniques can also improve quality of life, decrease medication use, and improve measures of lung function.[24,27]

HYPNOTHERAPY AND GUIDED IMAGERY

Contrary to popular belief, the purpose of a hypnotic state is not for people to lose control of their actions, but for them to develop heightened concentration or focus on an idea or image. The process may be brief and simple or more complex, depending on the patient, the clinician or provider, and the goals of treatment. Hypnotherapy has been shown effective in patients whose asthma is mild and whose asthma has an emotional component; in such cases, improvements were seen in terms of symptoms, medication use, and pulmonary function measures.[1]

Guided Imagery might be viewed as a form of self-hypnosis. After entering a relaxed state, a person creates an image intended to help reduce asthma symptoms. This method is

especially effective in children, who have active imaginations. It can be taught in one relatively short session, and patients can do well employing it with asthma symptoms after a few practice sessions.[1]

JOURNALING

Journaling for 20-30 minutes 3-5 times per week has been shown to reduce both symptoms and medication use. This may be especially helpful if the journaling is around stressful events; the purpose is not to catalog events but to allow for therapeutic disclosure.[1]

BREATHING EXERCISES

A 2013 review looked at breathing exercises to improve asthma in 13 studies involving 906 participants. The studies were heterogeneous with various outcomes measured. Overall, they did show a positive impact on aspects such as quality of life and lung function.[28] A specific Breathing Therapy is the Buteyko breathing technique, which consists of breathwork, relaxation exercises, and asthma education. The goal is to increase carbon dioxide concentration in the lungs, which will result in bronchodilation. Some evidence has shown the technique results in decreased use of rescue inhalers although further research is certainly needed.[29]

DIETARY SUPPLEMENTS & HERBAL REMEDIES

Note: Please refer to the [Passport to Whole Health](#), Chapter 15 on Dietary Supplements for more information about how to determine whether or not a specific supplement is appropriate for a given individual. Supplements are not regulated with the same degree of oversight as medications, and it is important that clinicians keep this in mind. Products vary greatly in terms of accuracy of labeling, presence of adulterants, and the legitimacy of claims made by the manufacturer.

INDIAN FRANKINCENSE (*BOSWELLIA SERRATA*)

There is some evidence that Boswellia can act as a mast cell stabilizer, improving forced expiratory volume and reducing the number of asthma attacks.[30] Typical dosing is 300 mg, 3 times per day, and it is generally very well tolerated.[1]

FRENCH MARITIME PINE (*PINUS PINASTER SPP. ATLANTICA*)

Pycnogenol® is the patented trade name for a water extract of the bark of the French maritime pine. Studies have shown adding Pycnogenol at a dose of 1 mg/pound of body weight to conventional medications may increase peak expiratory flow and decrease need for rescue medications in children ages 6-18 with asthma.[31]

LICORICE (*GLYCYRRHIZA GLABRA*)

Licorice's effect on asthma seems to come from its anti-inflammatory properties and its enhancement of endogenous steroids. In addition it has expectorant (aids expulsion of mucus) and demulcent (soothing to irritated airways) properties which can be beneficial in asthma.[6] There are several ways to use licorice, including:

- Dried root: 1-5 gm, 3 times daily
- Tincture: 2-5 mL of 1:5 strength, 3 times daily
- Standardized extract: 250-300 mg, 3 times daily, containing 20% glycyrrhizic acid

There are a few precautions to consider with licorice. Long-term use can cause headache, elevated blood pressure, hypokalemia, dizziness, and edema—apparently through the binding of mineralocorticoids. These effects are unlikely if taken at doses less than 10 mg of the glycyrrhizic acid over the short term.[1]

CHOLINE

Historically, choline has been considered a B vitamin, but it one that can be synthesized by the human body. It is readily available in the diet, especially in liver, muscle meats, fish, nuts, beans, peas, eggs, wheat germ, spinach, and other food groups. Findings show choline supplementation decreases the severity of asthma symptoms and need for rescue medications. While a typical diet provides 200-600 mg daily, doses of 3 gm daily seem to be more effective. [32]

HOMEOPATHY

There are few high-quality studies on homeopathy for asthma. A 2019 systemic review found a majority of the 16 studies included showed benefit in patients with asthma, especially those studies looking at more complex formulations. Study design and risk of bias were problematic in assessing the validity of the results.[33]

COMPLEMENTARY AND INTEGRATIVE HEALTH APPROACHES

ACUPRESSURE AND ACUPUNCTURE

Acupressure is a modality that uses pressure, applied to specific points on the body (acupuncture points) to improve health. There is some evidence that acupressure has the potential to improve quality of life in people with asthma. Acupuncture has shown to help prevent exercise-induced asthma and reduce the perceived level of breathlessness associated with asthma. A 2019 meta-analysis of nine studies showed that conventional treatment plus acupuncture for the treatment of asthma was superior in symptom response rate to conventional treatment alone. The available data is quite limited, however, and the quality of the studies is questionable.[34-36] However, given their safety and potential other benefits, a trial of acupuncture or acupressure can be considered.

Tian Jiu is a Chinese medicine noninvasive treatment that involves selecting stimulating Chinese herbs, grinding them into a powder mixed with ginger extract to form pellets and then pasting them onto specific acupuncture points on the hottest days of the year when pores open up, blood flows more freely, and the *yang qi* in the body is at its peak. A 2015 meta-analysis of six randomized control trials of this modality with participant numbers ranging from 60-200 showed benefit in all included studies but risk of bias was high.[37] A 2017 meta-analysis of 34 studies involving 3,313 participants, looking at this safe technique came to a similar conclusion: While risk of bias was high, use of herbal patching on specific acupoints during the hottest days of the year was superior to conventional treatment alone and to sham herbal patching in terms of reduction in asthma exacerbations and improving lung function.[38] This modality has been shown to improve pulmonary function and reduce levels of interleukin and immunoglobulin E.[39]

ALEXANDER TECHNIQUE

The Alexander technique centers around an educational program that aims to improve coordination and balance, reduce tension, relieve pain, alleviate fatigue, improve various medical conditions, and promote well-being.[40] It teaches movement patterns and postures. Alexander technique has been used in asthma to try to improve breathing. There is no convincing evidence supporting its efficacy, but a trial in interested patients is of low risk.[41]

OSTEOPATHY AND CHIROPRACTIC

Manual medicine has been used for a variety of acute and chronic symptoms. Osteopathic manipulation has been shown to improve peak flow measurements in the emergency room in children and adolescents with acute asthma symptoms.[1] The theory is that manipulation can increase vital capacity and rib cage mobility, improve diaphragmatic function, enhance clearing of airway secretions, and improve autoimmune function.[1] Chiropractic care has also been used, but studies are limited and results are more subjective than objective. That being said, a trial may be reasonable so long as precautions are observed—i.e., use caution with cervical adjustments as well as when a person has low bone density, unstable spondylolisthesis, acute arthritis, bleeding disorders, or vascular disease including aneurysms and vertebrobasilar insufficiency.[42]

MASSAGE

Massage has been studied for a variety of health concerns, including asthma in children. In this population, it can improve airway caliber and asthma control.[1] The impact of therapeutic human touch is likely to have other positive impacts on overall well-being, and massage can be considered a part of Personal Health Plan for many health conditions.

RESOURCE LINKS

- [Environmental Working Group](http://www.ewg.org/): <http://www.ewg.org/>
- [The Anti-Inflammatory Lifestyle](https://www.fammed.wisc.edu/files/webfm-uploads/documents/outreach/im/handout_ai_diet_patient.pdf): https://www.fammed.wisc.edu/files/webfm-uploads/documents/outreach/im/handout_ai_diet_patient.pdf
- [Promoting a Healthy Microbiome with Food and Probiotics](https://www.va.gov/WHOLEHEALTHLIBRARY/tools/promoting-healthy-microbiome-with-food-probiotics.asp): <https://www.va.gov/WHOLEHEALTHLIBRARY/tools/promoting-healthy-microbiome-with-food-probiotics.asp>
- [Spirit and Soul](https://www.va.gov/WHOLEHEALTHLIBRARY/self-care/spirit-soul.asp): <https://www.va.gov/WHOLEHEALTHLIBRARY/self-care/spirit-soul.asp>
- [Passport to Whole Health](https://www.va.gov/WHOLEHEALTHLIBRARY/docs/Passport_to_WholeHealth_FY2020_508.pdf): https://www.va.gov/WHOLEHEALTHLIBRARY/docs/Passport_to_WholeHealth_FY2020_508.pdf

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REFERENCES

1. Raket D. *Integrative Medicine*. 3rd ed. Philadelphia: Elsevier Saunders; 2012.
2. Carson KV, Chandratilleke MG, Picot J, Brinn MP, Esterman AJ, Smith BJ. Physical training for asthma. *Cochrane Database Syst Rev*. 2013;9:Cd001116.
3. Beggs S, Foong YC, Le HC, Noor D, Wood-Baker R, Walters JA. Swimming training for asthma in children and adolescents aged 18 years and under. *Cochrane Database Syst Rev*. 2013;4:Cd009607.
4. Therapeutic Research Center (TRC). Yoga. 2019; Natural Medicines. Health & Wellness online database. Available at: <https://naturalmedicines.therapeuticresearch.com/databases/health-wellness/professional.aspx?productid=1241>. Accessed January 15, 2020.
5. Yang ZY, Zhong HB, Mao C, et al. Yoga for asthma. *Cochrane Database Syst Rev*. 2016;4:Cd010346.
6. Raket D. Asthma. In: Raket D, ed. *Integrative Medicine*. 3rd ed. Philadelphia: Saunders Elsevier; 2012:258-267.
7. Abramson MJ, Puy RM, Weiner JM. Injection allergen immunotherapy for asthma. *Cochrane Database Syst Rev*. 2010(8):Cd001186.
8. Crinnion WJ. Do environmental toxicants contribute to allergy and asthma? *Altern Med Rev*. 2012;17(1):6-18.
9. Mukerjee D. Health impact of polychlorinated dibenzo-p-dioxins: a critical review. *J Air Waste Manag Assoc*. 1998;48(2):157-165.

10. Sauni R, Uitti J, Jauhiainen M, Kreiss K, Sigsgaard T, Verbeek JH. Remediating buildings damaged by dampness and mould for preventing or reducing respiratory tract symptoms, infections and asthma. *Cochrane Database Syst Rev*. 2011(9):Cd007897.
11. de Groene GJ, Pal TM, Beach J, et al. Workplace interventions for treatment of occupational asthma. *Cochrane Database Syst Rev*. 2011(5):Cd006308.
12. Haczku A, Panettieri RA, Jr. Social stress and asthma: the role of corticosteroid insensitivity. *J Allergy Clin Immunol*. 2010;125(3):550-558.
13. Forte GC, da Silva DTR, Hennemann ML, Sarmiento RA, Almeida JC, de Tarso Roth Dalcin P. Diet effects in the asthma treatment: A systematic review. *Crit Rev Food Sci Nutr*. 2018;58(11):1878-1887.
14. Abuabat F, AlAlwan A, Masuadi E, Murad MH, Jahdali HA, Ferwana MS. The role of oral magnesium supplements for the management of stable bronchial asthma: a systematic review and meta-analysis. *NPJ Prim Care Respir Med*. 2019;29(1):4.
15. Garcia-Larsen V, Del Giacco SR, Moreira A, et al. Asthma and dietary intake: an overview of systematic reviews. *Allergy*. 2016;71(4):433-442.
16. Afacan NJ, Fjell CD, Hancock RE. A systems biology approach to nutritional immunology - focus on innate immunity. *Mol Aspects Med*. 2012;33(1):14-25.
17. Kohatsu W. The Anti Inflammatory Diet. In: Raket D, ed. *Integrative Medicine*. 3rd ed. Philadelphia, PA: Saunders, an imprint of Elsevier, Inc; 2012:795-802.
18. Vitamin C. Natural Medicines Comprehensive Database website. <https://naturalmedicines.therapeuticresearch.com/databases/food,-herbs-supplements/professional.aspx?productid=1001>. Accessed June 24, 2020.
19. Li R, Guo C, Li Y, Liang X, Yang L, Huang W. Therapeutic target and molecular mechanism of vitamin C-treated pneumonia: a systematic study of network pharmacology. *Food Funct*. 2020;11(5):4765-4772.
20. Wu R, Wang L, Kuo HD, et al. An update on current therapeutic drugs teating COVID-19. *Curr Pharmacol Rep*. 2020:1-15.
21. Jolliffe DA, Greenberg L, Hooper RL, et al. Vitamin D supplementation to prevent asthma exacerbations: a systematic review and meta-analysis of individual participant data. *Lancet Respir Med*. 2017;5(11):881-890.
22. Luo J, Liu D, Liu CT. Can Vitamin D supplementation in addition to asthma controllers improve clinical outcomes in patients with asthma?: a meta-analysis. *Medicine*. 2015;94(50):e2185.
23. Welsh EJ, Bara A, Barley E, Cates CJ. Caffeine for asthma. *Cochrane Database Syst Rev*. 2010(1):Cd001112.
24. Yorke J, Fleming S, Shuldham C, Rao H, Smith HE. Nonpharmacological interventions aimed at modifying health and behavioural outcomes for adults with asthma: a critical review. *Clin Exp Allergy*. 2015;45(12):1750-1764.
25. Paudyal P, Jones C, Grindey C, Dawood R, Smith H. Meditation for asthma: Systematic review and meta-analysis. *J Asthma*. 2018;55(7):771-778.
26. Lask B, Matthew D. Childhood asthma. A controlled trial of family psychotherapy. *Arch Dis Child*. 1979;54(2):116-119.
27. Relaxation therapy. Natural Medicines Comprehensive Database website. <https://naturalmedicines.therapeuticresearch.com/databases/health-wellness/professional.aspx?productid=1239>. Accessed June 24, 2020.

28. Freitas DA, Holloway EA, Bruno SS, Chaves GS, Fregonezi GA, Mendonca KP. Breathing exercises for adults with asthma. *Cochrane Database Syst Rev*. 2013;10:Cd001277.
29. Domschke K, Deckert J. Genetics of anxiety disorders-status quo and quo vadis. *Curr Pharm Des*. 2012;18(35):5691-5698.
30. Gupta I, Gupta V, Parihar A, et al. Effects of Boswellia serrata gum resin in patients with bronchial asthma: results of a double-blind, placebo-controlled, 6-week clinical study. *Eur J Med Res*. 1998;3(11):511-514.
31. French Maritime Pine Bark Extract (PYCNOGENOL). Natural Medicines Comprehensive Database website. Available at: <http://naturaldatabase.therapeuticresearch.com/nd/Search.aspx?cs=&s=ND&pt=9&Product=French+maritime+pine+>. Accessed June 28, 2014.
32. Liang Y, Lenon GB, Yang AWH. Acupressure for respiratory allergic diseases: a systematic review of randomised controlled trials. *Acupunct Med*. 2017;35(6):413-420.
33. Qutubuddin M, Singh SM, Nayak C, Koley M, Saha S. A systematic review of controlled trials of homeopathy in bronchial asthma. *Complement Med Res*. 2019;26(2):111-117.
34. Acupuncture. Natural Medicines Comprehensive Database website. <https://naturalmedicines.therapeuticresearch.com/databases/health-wellness/professional.aspx?productid=1219>. Accessed June 24, 2020.
35. Jiang C, Jiang L, Qin Q. Conventional treatments plus acupuncture for asthma in adults and adolescent: a systematic review and meta-analysis. *Evid Based Complement Alternat Med*. 2019;2019:9580670.
36. Therapeutic Research Center (TRC). Choline. 2020; <https://naturalmedicines.therapeuticresearch.com/databases/food,-herbs-supplements/professional.aspx?productid=436>. Accessed July 21, 2020.
37. Chan CW, Lee SC, Lo KC, Wong HK, Li L. Tian jiu therapy for the treatment of asthma in adult patients: a meta-analysis. *J Altern Complement Med*. 2015;21(4):200-207.
38. Zhou F, Liang N, Maier M, Liu JP. Sanfu acupoint herbal patching for stable asthma: A systematic review and meta-analysis of randomised controlled trials. *Complement Ther Med*. 2017;30:40-53.
39. Su L, Meng L, Chen R, Wu W, Peng B, Man L. Acupoint application for asthma therapy in adults: a systematic review and meta-analysis of randomized controlled trials. *Forsch Komplementmed*. 2016;23(1):16-21.
40. Doll R, Peto R. The causes of cancer: quantitative estimates of avoidable risks of cancer in the United States today. *J Natl Cancer Inst*. 1981;66(6):1192-1308.
41. Dennis JA, Cates CJ. Alexander technique for chronic asthma. *Cochrane Database Syst Rev*. 2012;9:Cd000995.
42. Therapeutic Research Center (TRC). Chiropractic. National Medicines website. Available at: <https://naturalmedicines.therapeuticresearch.com/databases/health-wellness/professional.aspx?productid=1211>. Accessed July 23, 2020.