

NON-PHARMACOLOGICAL MANAGEMENT OF ASTHMA

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Abstract : Several forms of non pharmacological therapies , alternative and complementary medicine have been popular in various parts of the world for treatment of asthma .Most such interventions are used as preventive therapies .Many of them have been evaluated in recent times using the modern scientific tools and consensus guidelines have been issued regarding their use. Among the non-pharmacological therapies for primary prevention of asthma no effect has been seen with domestic aeroallergen avoidance, food allergen avoidance, modified milk formulae, modified weaning, nutritional supplements during pregnancy, dietary probiotics in pregnancy, immunotherapy and immunization. However, avoidance of tobacco smoking by parents and encouragement of breast-feeding are advised. Recent reviews also do not favor complementary and alternative medicine interventions like acupuncture, air ionisers, herbal and traditional chinese medicine and homeopathy

Asthma is a chronic inflammatory disorder of the airways in which many cells and cellular elements play a role. The chronic inflammation is associated with airway hyper responsiveness that leads to recurrent episodes of wheezing, breathlessness, chest tightness, and coughing, particularly at night or in the early morning. These episodes are usually associated with widespread, but variable, airflow obstruction within the lung that is often reversible either spontaneously or with treatment. Asthma is a common medical ailment, which affects the pediatric age group patients; there are various guidelines for management of asthma, which are periodically revised and form the basis for current understanding and management of asthma in children. Asthma management can be divided into 2 broad subgroups:

1. Non Pharmacological Management; 2.Pharmacological Management

NON-PHARMACOLOGICAL MANAGEMENT OF ASTHMA

There is a common thinking amongst care takers and patients that there are numerous environmental, dietary triggers of asthma and that avoiding these triggers will improve asthma and reduce the requirement for pharmacotherapy. Although effective medications for managing asthma exist within conventional western medicine (e.g., inhaled corticosteroids and bronchodilators), some parents turn to complementary and alternative medical (CAM) therapies to treat their children's asthma. Failure to address a patient, parent or a care takers concern about these issues may compromise concordance with recommended pharmacotherapy.

There are 2 types of **Prophylaxis**

- **Primary Prophylaxis** - interventions introduced before the onset of disease and designed to reduce its incidence.
- **Secondary Prophylaxis** - interventions introduced after the onset of disease to reduce its impact.

PRIMARY PROPHYLAXIS

The evidence for these strategies is based predominantly on observational studies, though some have been tested using experimental methods. Many of the studies are multifaceted and it can be difficult to disentangle the effects of one exposure or intervention from another.

1. Aeroallergen and food allergen avoidance

It is seen that exposure to high levels of house dust mite allergen in early life is associated with an increased sensitization to house dust mite by three to seven years of age. Sensitization to house dust mite is an important risk factor for the development of asthma and a few studies have suggested

that high early house dust mite exposure increases the risk of subsequent asthma while others have shown no effect on either allergic sensitization or symptoms of allergic diseases^{1,2}. It is also said that sensitization to foods like eggs precedes the development of aero allergy in children and subsequent asthma³. However it has been shown that the food allergen avoidance in pregnancy and postnatally has not been shown to prevent the later development of asthma⁴. In the absence of any evidence of benefit and given the potential for adverse effects, maternal food allergen avoidance during pregnancy and lactation is not recommended as a strategy for preventing childhood asthma and in the absence of consistent evidence of benefit from domestic aeroallergen avoidance it is not possible to recommend it as a strategy for primary prevention of childhood asthma.

2. Breast feeding

A review of observational studies on the allergy preventive benefits of breast-feeding reveals that it is effective for all infants irrespective of allergy, heredity. The preventive effect of breast-feeding for allergy was more pronounced in high-risk infants provided they are breast fed for at least four months⁵. However, not all the studies have demonstrated benefit and in a large birth cohort it was seen that there was no protective effect against atopy and asthma and maybe even an increase in risk^{6,7}. Breast-feeding should be encouraged for its multiple benefits, and it may also have a potential protective effect in relation to early asthma.

3. Modified Infant Milk Formulae

There are many trials of modified milk formulae but none have included sufficiently long follow up to establish whether there is any impact on asthma⁸. In the absence of any evidence of benefit from the use of modified infant milk formulae it is not possible to recommend it as a strategy for preventing childhood asthma.

4. Weaning

Early introduction of allergenic foods into the infant diet predisposes the infant to subsequent development of allergy and atopic eczema. However, in one study, it was seen that late introduction of egg was associated with a non-significant increase in pre-school wheezing⁹. In the absence of evidence on outcomes in relation to asthma no recommendations on modified weaning can be made.

5. Nutritional supplementation in pregnancy - fish oils (n-3 pufas)

Its seen that western diets have a low intake of n-3 PUFAs with a corresponding increase in intake of n-6 PUFAs and this change in diet has been associated with increasing rates of allergic disease and

asthma. However, there are no good studies to support this¹⁰. In the absence of any evidence of benefit from the use of fish oil supplementation in pregnancy it is not possible to recommend it as a strategy for preventing childhood asthma.

6. *Microbial Exposure*

The well known “hygiene hypothesis” of asthma suggests that early exposure to microbial products would switch off allergic responses thereby preventing allergic diseases such as asthma. The hypothesis was supported by some epidemiological studies, which compared large populations who have or have not had such exposure^{11,12}. In a double blind placebo controlled trial of the probiotic lactobacillus GG was given to mothers and it was seen that it resulted in a reduced incidence of atopic eczema in their children but had no effect on IgE antibody or allergic skin test responses¹³. There is insufficient evidence to indicate that the use of dietary probiotics in pregnancy reduces the incidence of childhood asthma.

7. *Avoidance of tobacco smoke and other air pollutants*

In various clinical trials and studies no evidence has been found to support a link between exposures to environmental tobacco smoke (ETS) or other air pollutants and the induction of allergy. However, it is seen that there is an increased risk of infant wheezing with maternal smoking during pregnancy which adversely affects infant lung function¹⁴ and there is ample evidence, which suggests that early life ETS exposure is associated with later persistent asthma^{15,16}. Parents and parents-to-be should be advised of the many adverse effects which smoking has on their children including increased wheezing in infancy and increased risk of persistent asthma.

8. *Immunisation*

In keeping with the “microbial exposure hypothesis” some studies have suggested that there is an association between tuberculin responsiveness and subsequent reduced prevalence of allergy, suggesting a protective effect of BCG¹⁷. However investigation of the effects of any other childhood immunization suggests that at worst there is no influence on subsequent allergic disease and maybe some protective effect against the development of asthma¹⁸. All childhood immunizations should proceed normally as there is no evidence of an adverse effect on the incidence of asthma.

SECONDARY PROPHYLAXIS

1. (a) *House Dust Mite Avoidance*

It has been seen that increased allergen exposure in sensitized individuals is associated with an increase in asthma symptoms, bronchial hyper-responsiveness and deterioration in lung function; however, evidence that reducing allergen exposure can reduce morbidity and/or mortality in asthma, is not clear. Cochrane reviews on house dust mite control measures in a normal domestic environment have concluded that chemical and physical methods aimed at reducing exposure to house dust mite allergens cannot be recommended.

(b) *Other Allergens*

Animal allergens, particularly of cat have been observed to be potent provokers of asthma symptoms. But the reported effects of removal of pets from homes are paradoxical, with either no benefit for asthma or a potential for continued high exposure to induce a degree of tolerance. It is seen that individual aeroallergen avoidance strategies have shown that single intervention has limited or no benefit. A multi

faceted approach is more likely to be effective if it addresses all the indoor asthma triggers. A systematic review of this topic concluded that more research is required.

2. *Smoking*

Direct or passive exposure to cigarette smoke negatively affects quality of life, lung function of the child and increase the need for rescue medications for acute episodes of asthma and long-term control with inhaled steroids. There are two studies, which have demonstrated that there was reduction in childhood asthma severity when parents stopped smoking. Along with this fact it is seen that uptake of smoking in teenagers increases the risks of persisting asthma^{19,20}. One study showed a doubling of risk for the development of asthma over six years in 14-year-old children who started to smoke in teenage²¹. Parents with asthma should be advised about the dangers of smoking to themselves and their children with asthma and offered appropriate support to stop smoking.

3. *Air Pollution*

Pollutants can increase the response of patients with asthma to allergen inhalation. Research suggest that air pollution may provoke acute asthma attacks or aggravates existing chronic asthma although the effects of this are very much less than those with infection or allergen exposure²².

4. *Immunotherapy*

Two modes of administration of immunotherapy have been studied

a) Subcutaneous immunotherapy – There have been trials of immunotherapy in which subcutaneous injection of increasing doses of allergen extracts was given and they have consistently demonstrated beneficial effects compared with placebo in the management of allergic asthma. Allergens that were included in trial were house dust mite, grass pollen, tree pollen, cat and dog allergen and moulds. Cochrane reviews were done and it has concluded that immunotherapy reduces asthma symptoms, the use of asthma medications and improves bronchial hyper-reactivity. The most recent review included 36 trials with house dust mite, 20 with pollen, 10 with animal allergens, two with cladosporium mould, one with latex and six with multiple allergens²³. However evidence comparing the roles of immunotherapy and pharmacotherapy in the management of asthma is lacking. Immunotherapy can be considered in patients with asthma where a clinically significant allergen cannot be avoided. The potential for severe allergic reactions to the therapy must be fully discussed with patients

b) *Sublingual immunotherapy*

Recently there has been increasing interest in the use of sublingual immunotherapy, as it is associated with fewer adverse reactions than subcutaneous immunotherapy. A systematic review done suggested there were some benefits for asthma control but the magnitude of the effect was small. Thus further randomized controlled trials are required. Sublingual immunotherapy cannot currently be recommended for the treatment of asthma in routine practice.

5. *Dietary Manipulation*

· *Electrolytes*

Various electrolytes were studied for their implication in asthma management. Of these two important and most widely studied are sodium and magnesium. *Increasing dietary sodium* has been implicated in the geographical variations in asthma mortality and high sodium intake is associated with increased bronchial hyper-responsiveness in various studies. A systematic review was done of

intervention studies reducing salt intake, which revealed that there was only minimal effects, and concluded that dietary salt reduction could not be recommended in the management of asthma²⁴.

Low magnesium intakes have been associated with a higher prevalence of asthma with increasing intake resulting in reduced bronchial hyper-responsiveness and higher lung function. Magnesium plays a beneficial role in the treatment of asthma through bronchial smooth muscle relaxation thus it is used as IV preparation in acute asthma management. The researches of oral supplementation are limited and more trials are required^{25,26}.

◆ Fish Oils/Lipids

Its suggested that supplementing the diet with omega n-3 fatty acids, which are most commonly found in fish oils, might reduce the inflammation associated with asthma. However Cochrane review of nine randomized controlled trials concluded that there was insufficient evidence to recommend fish oil supplementation for the treatment of asthma²⁷.

◆ Weight Reduction In Obese Patients

Several studies done have reported an association between increasing body mass index and its effects on symptoms of asthma in patients^{28,29}. A randomized parallel group study has shown improved asthma control following weight reduction in obese patients with asthma³⁰. Weight reduction is recommended in obese patients with asthma to promote general health and to improve asthma control.

◆ Probiotics

Studies have suggested a role of imbalance in gut flora and higher risk of development of allergy³¹. The use of probiotics in the treatment of established allergic disease has been investigated and the study focused on asthma, finding a decrease in eosinophilia but no effect on clinical parameters^{32,33}. In the absence of evidence of benefit, it is not possible to recommend the use of probiotics in the management of asthma.

IMMUNISATIONS

There are studies that have concluded that high vaccination coverage has no significant impact on any allergic outcome or asthma^{34,35}. However there is a suggestion that the higher the vaccine coverage the greater the protection against the development of allergy in the first years of life. There is some discussion about whether BCG immunization may confer protection against allergy and asthma. The use of BCG, with or without allergen, as a means to switch off allergic immune responses has been investigated but results are not very clear and this is an area that requires further investigation³⁶.

There has been earlier concern that influenza vaccination might aggravate respiratory symptoms in patients of asthma, though any such effect would be outweighed by the benefits of the vaccination. However research done in children have suggested that immunization with the vaccine does not exacerbate asthma³⁷ but has a small beneficial effect on quality of life in children with asthma.

Immunizations should be administered independent of any considerations related to asthma. High-dose inhaled steroids may attenuate responses to vaccines

IVY LEAF

Ivy leaf, the dried leaf of *Hedera helix* L., is believed to have bronchodilating, spasmolytic, and antibacterial effects. Ivy leaf has been used for the treatment of upper respiratory tract infections and coughs³⁸. A review of three small German-language trials, including crossover, double-blind trials, examining the efficacy of ivy leaf cough drops, suppositories, or syrup in children who had asthma found

ivy leaf in all forms to improve respiratory function³⁸. Only one adverse event (AE) of ivy treatment, exacerbation of existing atopic dermatitis, was reported in one of these trials. Although this preliminary evidence suggests that ivy leaf may improve airway resistance in children who have asthma, larger RCTs and additional safety data, are needed before ivy supplements can be recommended

COMPLEMENTARY AND ALTERNATIVE MEDICINE IN ASTHMA

(I) Acupuncture

A Cochrane review of 21 trials on acupuncture highlighted many methodological problems with the studies. The review concluded that there was no evidence for a clinically valuable benefit for acupuncture and no significant benefits in relation to lung function

(II) Air Ionisers

Ionisers are widely being promoted as being of benefit for patients with asthma. But a Cochrane review of five studies using negative ion generators and one with a positive ion generator found that there was no evidence of benefit in reducing symptoms in patients with asthma³⁹.

(III) Breathing Exercises Including Yoga And The Buteyko Breathing Technique

The basic principle of yoga and Buteyko breathing technique are to control hyperventilation by lowering respiratory frequency. A Cochrane review of breathing exercises found that there was no change in routine measures of lung function after these techniques⁴⁰. However one study showed a small reduction in airway responsiveness to histamine utilizing pranayama, a form of yoga breathing exercise⁴¹. The Buteyko breathing technique focuses specially on control of hyperventilation and any reduction on pCO₂ levels. Some clinical trials have suggested that there were benefits in terms of reduced symptoms and bronchodilator usage but no effect on lung function⁴²⁻⁴³. Buteyko breathing technique may be considered to help patients to control the symptoms of asthma.

(IV) Herbal And Traditional Chinese Medicine (TCM)

TCM herbal remedies include mixtures of several herbs that have different physiologic effects. Huntley and Ernst conducted a systematic review of 17 RCTs investigating the effectiveness of herbal medicines in asthma, six of which evaluated the effects of TCM⁴⁴. It was found that all of the TCM trials were of poor methodological quality, as assessed by the Jadad scale, which evaluates the quality of clinical trials (i.e., lack of blinding or sufficient information about randomization, dropouts, or AEs). In the literature there are various reported side effects associated with TCM preparations from China that have been contaminated with toxins (i.e., heavy metals such as arsenic or mercury) or adulterated with prescription medications such as glucocorticosteroids⁴⁵. Given the poor quality of data on effectiveness and the substantial concerns about product variability and adulteration, TCM herbs are not recommended in the treatment of pediatric asthma

(V) Homeopathy

In the Cochrane review it identified that only three methodologically sound randomized controlled trials are there out of which two have reported some positive effects. But the studies did not employ individualized homeopathy, which is the essence of this approach to treatment⁴⁶. In a recent trial of homeopathy in childhood asthma, which was placebo controlled and appropriately powered it was

revealed that there was no benefit over conventional treatment in primary care ⁴⁷.

REFERENCES

- Corver K, Kerkhof M, Brussee JE, Brunekreef B, van Strien RT, Vos AP, et al. House dust mite allergen reduction and allergy at 4 yr: follow up of the PIAMA-study. *Pediatr Allergy Immunol* 2006; 17:329-36.
- Sporik R, Holgate ST, Platts-Mills TA, Cogswell JJ. Exposure to house-dust mite allergen (Der p 1) and the development of asthma in childhood. *N Engl J Med* 1990; 323:502-7
- Muraro A, Dreborg S, Halken S, Host A, Niggemann B, Aalberse R, et al. Dietary prevention of allergic diseases in infants and small children. Part I: immunologic background and criteria for hypoallergenicity. *Pediatr Allergy Immunol* 2004;15:103-11.
- Muraro A, Dreborg S, Halken S, Host A, Niggemann B, Aalberse R, et al. Dietary prevention of allergic diseases in infants and small children. Part III: Critical review of published peer-reviewed observational and interventional studies and final recommendations. *Pediatr Allergy Immunol* 2004;15:291-307.
- Kramer MS, Kakuma R. Maternal dietary antigen avoidance during pregnancy or lactation, or both, for preventing or treating atopic disease in the child (Cochrane Review). In: *The Cochrane Library*, Issue 3, 2006. London: John Wiley & Sons Ltd138. Vance GH, Grimshaw KE, Briggs R, Lewis SA, Mullee MA, Thornton CA, et al. Serum ovalbumin-specific immunoglobulin G responses during pregnancy reflect maternal intake of dietary egg and relate to the development of allergy in early infancy. *Clin Exp Allergy* 2004;34:1855-61.
- van Odijk J KI, Borres MP, Brandtzaeg P, Edberg U, Hanson LA, Host A, Kuitunen M, Olsén SF, Skerfving S, Sundell J, Willie S. Breast feeding and allergic diseases: a multi-disciplinary review of the literature (1996-2001) on the mode of early feeding in infancy and its impact on later atopic manifestations. *Allergy* 2003;58:833-43.
- Sears MR, Greene JM, Willan AR, Taylor DR, Flannery EM, Cowan JO, et al. Long-term relation between breastfeeding and development of atopy and asthma in children and young adults: a longitudinal study. *Lancet*. 2002;360:901-7.
- Osborn DA, Sinn J. Formulas containing hydrolysed protein for prevention of allergy and food intolerance in infants (Cochrane Review). In: *The Cochrane Library*, Issue 4, 2006. Chichester: John Wiley
- Zutavern A, von Mutius E, Harris J, Mills P, Moffatt S, White C, et al. The introduction of solids in relation to asthma and eczema. *Arch Dis Child*. 2004;89:303-8.
- Mührshahi S, Peat JK, Webb K, Oddy W, Marks GB, Mellis CM, et al. Effect of omega-3 fatty acid concentrations in plasma on symptoms of asthma at 18 months of age. *Pediatr Allergy Immunol*. 2004;15:517-22.
- Holt PG, Sly PD, Björkstén B. Atopic versus infectious diseases in childhood: a question of balance? *Pediatr Allergy Immunol* 1997;8:53-8.
- Strachan DP. Family size, infection and atopy: the first decade of the "hygiene hypothesis". *Thorax* 2000;55:52-10.
- Kalliomaki M, Salminen S, Arvilommi H, Kero P, Koskinen P, Isolauri I. Probiotics in primary prevention of atopic disease: a randomized placebo-controlled trial. *Lancet* 2001;357:1076-9.
- Gilliland FD, Berhane K, McConnell R, Gauderman WJ, Vora H, Rappaport EB, et al. Maternal smoking during pregnancy, environmental tobacco smoke exposure and childhood lung function. *Thorax* 2000;55:271-6.
- Arshad SH, Kurukulaaratchy RJ, Fenn M, Matthews S. Early life risk factors for current wheeze, asthma, and bronchial hyperresponsiveness at 10 years of age. *Chest* 2005;127:502-8.
- Jaakkola JJ, Gissler M. Maternal smoking in pregnancy, fetal development, and childhood asthma. *Am J Public Health* 2004;94:136-40.
- Kemp A, Björkstén B. Immune deviation and the hygiene hypothesis: a review of the epidemiological evidence. *Pediatr Allergy Immunol* 2003;14:74-80.
- Martignon G, Orszyczyn MP, Annesi-Maesano I. Does childhood immunization against infectious diseases protect from the development of atopic disease? *Pediatr Allergy Immunol* 2005;16:193-200.
- Murray AB, Morrison BJ. The decrease in severity of asthma in children of parents who smoke since the parents have been exposing them to less cigarette smoke. *J Allergy Clin Immunol* 1993;91:102-10.
- Wilson SR, Yamada EG, Sudhakar R, Roberto L, Mannino D, Mejia C, et al. A controlled trial of an environmental tobacco smoke reduction intervention in low-income children with asthma. *Chest*. 2001;120:1709-22.
- Rasmussen F, Siersted HC, Lambrechtsen J, Hansen HS, Hansen NC. Impact of airway lability, atopy, and tobacco smoking on the development of asthma-like symptoms in asymptomatic teenagers. *Chest* 2000;117:1330-5.
- Lin M, Chen Y, Burnett RT, Villeneuve PJ, Krewski D. Effect of short-term exposure to gaseous pollution on asthma hospitalisation in children: A bi-directional case-crossover analysis. *J Epidemiol Community Health*. 2003;57:50-5.
- Abramson MJ, Puy RM, Weiner JM. Allergen immunotherapy for asthma (Cochrane Review). In: *The Cochrane Library*, Issue 4, 2003. London: John Wiley & Sons Ltd
- Mickleborough TD, Lindley MR, Ray S. Dietary salt, airway inflammation, and diffusion capacity in exercise-induced asthma. *Med Sci Sports Exerc*. 2005;37:904-14.
- Ardern KD, Ram FS. Dietary salt reduction or exclusion for allergic asthma (Cochrane Review). In: *The Cochrane Library*, Issue 4, 2001. London: John Wiley & Sons Ltd.
- Fogarty A, Lewis SA, Scrivener SL, Antoniak M, Pacey S, Pringle M, et al. Oral magnesium and vitamin C supplements in asthma: a parallel group randomized placebo-controlled trial. *Clin Exp Allergy*. 2003;33:1355-9.
- Woods RK, Thien FC, Abramson MJ. Dietary marine fatty acids (fish oil) for asthma (Cochrane Review). In: *The Cochrane Library*, Issue 3, 2001. London: John Wiley & Sons Ltd.
- Castro-Rodriguez JA, Holberg CJ, Morgan WJ, Wright AL, Martinez FD. Increased incidence of asthma like symptoms in girls who become overweight or obese during the school years. *Am J Respir Crit Care Med*. 2001;163:1344-9.
- Ford ES. The epidemiology of obesity and asthma. *J Allergy Clin Immunol* 2005;115:897-909.
- Stenius-Aarniala B, Poussa T, Kvarnstrom J, Gronlund EL, Ylikari M, Mustajoki P. Immediate and long term effects of weight reduction in obese people with asthma: randomised controlled study. *BMJ* 2000;320:827-32.
- Björkstén B, Sepp E, Julge K, Voor T, Mikelsaar M. Allergy development and the intestinal microflora during the first year of life. *J Allergy Clin Immunol* 2001;108:516-20.
- Helin T, Hahtela S, Hahtela T. No effect of oral treatment with an intestinal bacterial strain, *Lactobacillus rhamnosus* (ATCC 53103), on birch-pollen allergy: a placebo-controlled double-blind study. *Allergy* 2002;57:243-6.
- Isolauri E, Arvola T, Sutas Y, Moilanen E, Salminen S. Probiotics in the management of atopic eczema. *Clin Exp Allergy* 2000;30:1604-10.
- Gruber C, Ili S, Lau S, Nickel R, Forster J, Kamin W, et al. Transient suppression of atopy in early childhood is associated with high vaccination coverage. *Pediatrics* 2003;111:e282-8.
- Nilsson L, Kjellman NI, Björkstén B. A randomized controlled trial of the effect of pertussis vaccines on atopic disease. *Arch Pediatr Adolesc Med* 1998;152:734-8.
- Arikan C, Bahceceliler NN, Deniz G, Akdis M, Akkoc T, Akdis CA, et al. Bacillus Calmette-Guérin-induced interleukin-12 did not additionally improve clinical and immunologic parameters in asthmatic children treated with sublingual immunotherapy. *Clinical & Experimental Allergy* 2004;34:398-405.
- Nicholson KG, Nguyen-Van-Tam JS, Ahmed AH, Wiselka MJ, Leese J, Ayres J, et al. Randomised placebo-controlled crossover trial on effect of inactivated influenza vaccine on pulmonary function in asthma. *Lancet* 1998;351:326-31.
- Hofmann D, Hecker M, Volp A. Efficacy of dry extract of ivy leaves in children with bronchial asthma - a review of randomized controlled trials. *Phytomed*. 2003;10:213-220
- Blackhall K, Appleton S, Cates CJ. Ionisers for chronic asthma (Cochrane Review). In: *The Cochrane Library*, Issue 3, 2003. London: John Wiley & Sons Ltd.
- Holloway E, Ram FSF. Breathing exercises for asthma (Cochrane Review). In: *The Cochrane Library*, Issue 3, 2001. London: John Wiley & Sons Ltd.
- Singh V, Wisniewski A, Britton J, Tattersfield A. Effect of yoga breathing exercises (pranayama) on airway reactivity in subjects with asthma. *Lancet* 1990;335:1381-3.
- Cooper S, Osborne J, Newton S, Harrison V, Thompson Coon J, Lewis S, et al. Effect of two breathing exercises (Buteyko and pranayama) in asthma: a randomised controlled trial. *Thorax* 2003;58:674-9.
- McHugh P, Aitchison F, Duncan B, Houghton F. Buteyko breathing technique for asthma: An effective intervention. *N Z Med J* 2003; 116:U710.
- Huntley A, Ernst E. Herbal medicines for asthma: a systematic review. *Thorax*. 2000; 55:925-929

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