

# Stress and Cortisol in Kids and Teens Botanical Options for Support



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# Introduction

The effects of stress can impact overall health and day-to-day activities. Stress is not just an issue that affects adults; infants, toddlers and teens can be equally affected by stress. In recent years, studies have been conducted that have proven that women react differently to stress than men. Because most of the stress studies performed were conducted on men, scientific exploration into the effects of stress on women was necessary to understand the full scope of the effects of stress. The same might be said for children.

Children undergo rapid stages of growth both in body and brain. Behavioral, psychological and social growth can have an impact on stress in infants, toddlers, young children and teenagers. These developmental stages are marked by different points of growth and hormones associated with stress. Because stress is an inevitable occurrence for children and adults it is important to think about ways to modulate stress.

This report will examine the best ways to minimize the effects of stress in children and the various types of botanical medicines that can be used in children and teens to help combat stress.

## Cortisol

Cortisol is one of the main stress hormones. Children with higher levels of glucocortisone are more apt to have problems in their physical, social, and mental development. Persistent increased cortisol levels in infants and young children can lead to smaller brain electrical changes when forming memories. This can compromise new memory formation. Memory, attention span and self-regulation are all influenced by cortisol production.

When self-regulation is not learned, or it is inhibited by other hormone activity in the body, children can have issues regulating behaviors and emotions. Children who have increased levels of cortisol during daycare or nursery school time experience extreme hardship maintaining attention. Because maintaining attention is a part of self-regulation, these children are not able to regulate behaviors due to high cortisol levels.

In adults, stress can affect normal daily activities or functions. But in children, stress can interrupt the ability to establish attention, a crucial element to the learning process that can potentially lead to attention issues later in life.

Studies have consistently shown that children exposed to long-term maternal stress and continued early life exposure to cortisol have an increased risk of developing early emotional disorders.

Long-term increased cortisol may also lead to behavioral problems and aggression. Evaluating what the early developmental environment was like for the child may provide information about angry or anxious behavior. Determining whether or not a child had control of emotions or the ability to self-regulate can provide context about a child's behavior. <sup>1</sup>

## Chronic Stress in Children

Chronic stress in children can lead to significant biological, physiological and behavioral changes. It leads to long-term chronic arousal of brainstem activity, which increases blood pressure, heart rate and arousal states. When a child is under these arousal states for long periods of time, biological, physiological and behavioral changes can occur. Changes in brain chemistry can lead to anxiety, depression or hyperactivity.

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<sup>1</sup>Gunnar, Megan R., and Ronald G. Barr. "Stress, Early Brain Development, and Behavior." *Inf Young Children* 11.1 (1998): 1-14

Chronic stress in children can alter and impair brain circuit formation. Brain circuit formations are an important part of early development. Studies have found that impairments to these circuits can result in a smaller brain size for younger children.<sup>2</sup>

Understanding and evaluating the source of stress is an important element to evaluating and treating stress. It is important to evaluate the amount of stress the child exposed to. Understanding if the source of the child's stress is from a social or family environment can help determine how stress can be reduced. Evaluating these factors can also determine if the cause of stress is socially related or if it has to do with nutritional deficiencies.

## **Stress and Health Risk Behaviors in Adolescents**

Chronic stress in adolescents and teens can contribute to risky, self-damaging and sometimes violent behavior. It can often lead to the use of substances such as alcohol or drugs. Race, socioeconomic status and gender can often influence the presence of chronic stress in teenagers. Chronic stress can also lead to depression or anxiety.<sup>3,4,5</sup>

## **Parental Stress and Adolescent Health**

Lack of family support or a supportive network can be a source of stress for adolescents. Parental stress from financial, work or relationship issues can also affect a teen's level of stress. When a teen's parents have large amounts of stress in their lives, it can create a rebound effect for the adolescent. This can lead to chronic stress that can lead to the deterioration of physiology. An increasing number of teens have asthma that is related to parental stress. Parental stress has been shown to affect the teen's immune system, increasing the risk for more frequent illness.<sup>6,7,8</sup>

## **Stress-Related Health Issues**

Stress can be physiologically damaging to children and teens. Some stress-related health issues include:

- Growth and development in brain and body
- Mood disorders
- Anger and irritability
- Anxiety

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<sup>2</sup> Middlebrooks JS, Audage NC. The Effects of Childhood Stress on Health Across the Lifespan. Atlanta (GA): Centers for Disease Control and Prevention, National Center for Injury Prevention and Control; 2008

<sup>3</sup> Copeland-Linder N, Lambert SE, et al. "Contextual stress and health risk behaviors among African American adolescents." *J Youth Adolesc* (2011 Feb) 40(2):158-73

<sup>4</sup> Zamboanga BL, Schwartz SJ, et al. "Acculturation and substance use among Hispanic early adolescents: investigating the mediating roles of acculturative stress and self-esteem." *J Prim Prev* (2009 Jul) 30(3-4):315-33

<sup>5</sup> Aldridge-Gerry AA, Roesch SC, et al. "Daily stress and alcohol consumption: modeling between-person and within-person ethnic variation in coping behavior." *J Stud Alcohol Drugs* (2011 Jan) 72(1):125-34

<sup>6</sup> Islam T, Urman R, et al. "Parental stress increases the detrimental effect of traffic exposure on children's lung function." *Am J Respir Crit Care Med* (2011 Oct 1) 184(7):822-7

<sup>7</sup> Dreger LC, Kozyrskyj AL, et al. "Lower cortisol levels in children with asthma exposed to recurrent maternal distress from birth." *J Allergy Clin Immunol* (2010 Jan) 125(1):116-22

<sup>8</sup> Wyman PA, Moynihan J, et al. "Association of family stress with natural killer cell activity and the frequency of illnesses in children." *Arch Pediatr Adolesc Med* (2007 Mar) 161(3):228-34

- Depression
- PTSD
- Insomnia
- Behavioral and focus disorders
- Metabolic disorders
- Obesity
- Fatty liver, DMII

## **Growth and Development**

Growth and development can be affected by stress, particularly in teens, children and infants. High levels of prolonged, ongoing stress hormones can be particularly damaging to children as it can affect growth and development of both the brain and body.

## **Mood Disorders**

Stress can cause mood disorders. In teens, the most common forms of mood disorders are anger, irritability, depression, anxiety and even Post Traumatic Stress Disorder (PTSD). PTSD in children and teens can inhibit normal developments.

## **Insomnia**

Insomnia is a common way that stress manifests in children. Sleep disorders should be monitored and treated as necessary.

## **Behavioral and Focus Disorders**

Behavioral and focus disorders are common in children and teens and can cause a variety of issues as noted previously.

## **Metabolic Disorders**

Metabolic disorders for children and teens include obesity and fatty liver disease. Teens are more prone to diabetes Type 2.

# **Why Botanical Medicines**

Botanical medicines can be an effective method to treat stress because they address numerous elements at once. Herbal medicines offer a unique way to support, strengthen and regulate the entire endocrine system and aid in managing common symptoms of stress including anxiety, insomnia, depression, moodiness, poor focus, distraction and restlessness.

# **Two Groups of Botanical Medicines**

Botanical medicines are typically classified into two groups: adaptogen agents and nervines and relaxant agents.

## **Adaptogen Agents**

Botanical adaptogen agents help the body mediate, modulate and adapt to stress. Botanical adaptogens can be used to treat chronic stress in infants, children and teens. These

remedies can help children mediate stress so that normal physiological growth can occur. Botanical adaptogens elicit a state of raised resistance in the body to all types of stressors, including biological, psychological, social, emotion and environmental. Adaptogens enhance normal body functions and help to restore balance in the endocrine, immune and nervous systems. Adaptogens can be used in both short-term and long-term therapeutic plans. Adaptogens that can be used in both short term and long term therapeutic plans include:

- Ashwagandha root (*Withania somnifera*)
- Astragalus root (*A. membranaceus*)
- Holy basil (*Ocimum sanctum*)
- Eleutherococcus root (*E. senticosus*)
- Ganoderma lucidum (Reishi)
- Siberian Asiatic rose root (*Rhodiola rosea*)

### **Botanical Nervines and Relaxing Agents**

Though adaptogens can provide numerous benefits in the treatment of stress, this report will focus on the efficacy of botanical nervines and relaxing agents. These agents address many common stress-related symptoms. They can revitalize, protect and support the body in a number of ways.

Four botanical nervines and relaxing agents that are kid-friendly and can be used in different forms include:

- Lemon balm (*Melissa officinalis*)
- Passionflower (*Passiflora incarnata*)
- American skullcap (*Scutellaria lateriflora*)
- Chamomile flower (*Chamomilla recutita*)

Combining nerve tonics such as American skullcap or lemon balm with adaptogens like ashwagandha and holy basil can yield extremely effective results in treating stress.

### **Lemon Balm (*Melissa Officinalis*)**

Lemon balm has medicinal uses that have been used both traditionally and in folklore. It is a member of the Labiatae family and is most commonly used to treat insomnia, restlessness, hyperactivity, anxiety, nervousness and agitation.

It has been shown to improve cognitive function and has been used to help manage Alzheimer's clients. Lemon balm has anti-viral and anti-microbial effects. It also has anti-spasmodic analgesic qualities that can be helpful in treating gastrointestinal disorders.

#### ***Active Constituents***

The phenolic acids, also known as Rosmarinic acids, are an important element of lemon balm. Rosmarinic acid is a strong antioxidant and has effects on inflammation and spasms. Essential oils are composed of monoterpenes and sesquiterpenes. In lemon balm, the essential oils are found primarily in the upper third of the plant.

Terpenes are an important element of the mood-elevating, anti-anxiety, anti-depressive and cognitive function effects of lemon balm. Eugenol and citral are strong antimicrobial agents that work in the nervous system on GABA receptors. Because lemon balm is in the mint family, tannis is a constituent of the plant.<sup>10</sup>

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<sup>10</sup> Braun, L. "Herbs and Natural Supplements: An evidence-based guide." Elsevier Australia 2007, 452-455

### ***Lemon Balm Study***

A double-blind placebo study comprised of 18 volunteers looked at the effectiveness of 300 and 600 mg doses of lemon balm and a placebo. The outcomes showed that the 600 mg dose of lemon balm improved mood and significantly increased calmness and alertness. Dose-specific increases in calmness, and dose-dependent decrements in timed memory task performance were also noted.<sup>11</sup>

### ***Study: Lemon Balm and Valerian Use in Children***

Lemon balm and valerian are commonly used together. A multi-center study comprised of 918 children, less than 12 years of age, evaluated the effects of valerian and lemon balm in the treatment of restlessness and nervous insomnia. The children were evaluated for therapeutic efficacy and tolerability. Overall, the combination of herbs was very well tolerated. Ultimately, the treatment was most effective in younger children with restlessness and insomnia.<sup>12</sup>

### ***Study: Lemon Balm and Valerian Use in Adults***

A double-blind, randomized, placebo-controlled, balanced cross-over case study comprised of 24 healthy volunteers evaluated the effectiveness of lemon balm and valerian use in adults. Volunteers were given 3 separate single doses of a standardized product of *M. officinalis* and *V. officinalis* extracts at 600, 1200 and 1800 mg. A placebo was also administered. Doses were given on separate days with a seven day wash out period between each dose. Overall, results of the study showed that the combination of herbs possessed anti-anxiolytic properties, helping to diminish anxiety; however, the highest doses of 1800 mg was showed to increase anxiety. In the end, the 1600 mg dose was most effective and least likely to cause anxiety.<sup>13</sup>

### ***Dosing***

Lemon balm can be given in the following doses:

- Capsules: 300, 600 or 900 mg dried lemon balm daily
- Tea: 1.5-4.5 g/150ml water infused tea daily
- Tincture: 1:5, 3-5 ml daily
- Fluid Extract 1:1, 2-3 ml daily
- Topical: Apply topical cream to affected area, three times daily or as directed for antiviral, antibacterial and antifungal uses

### ***Contraindications and Safety***

Lemon balm is generally well-tolerated. There are no known drug interactions or clinic studies on thyroid inhibiting effects. However, several test tube studies have shown that Rosmarinic acid in its more concentrated form has some inhibiting affects. For this reason, caution should be used with hypothyroid patients who are medicated.

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<sup>11</sup> Kennedy DO, Scholey AB, Tildesley NT, et al. Modulation of mood and cognitive performance following acute administration of *Melissa officinalis* (lemon balm), *Pharmacol Biochem Behav* (2002 Jul) 72(4):953-64

<sup>12</sup> Muller SF, Klement S, *Phytomedicine* (2006 Jun) 13(6):383-7

<sup>13</sup> Kennedy DO, Little W, Haskell CF, Scholey AB. Anxiolytic effects of a combination of *Melissa officinalis* and *Valeriana officinalis* during laboratory induced stress, *Phytother Res* (2006 Feb) 20(2):96-102

## Passionflower (*Passiflora Incarnata*)

The leaves and aerial parts of *Passiflora incarnata* are used in botanical remedies. The active constituents of passionflower include:

- Flavonoids-apigenin, quercetin, luteolin
- Indole alkaloids- harman, harmine
- Gamma-amino butyric acid (GABA)
- Phytosterols



Figure 1

### *Clinical Indications in Children and Teens*

Passionflower is indicated in anxiety or General Anxiety Disorder, one of the reasons it is often used for teens. It is also used to treat children and teens with insomnia. Passionflower can help minimize nervousness, particularly when combined lemon balm. Passionflower is also used to treat ADHD and palpitations.

### *Study: Passiflora Incarnata and Sleep Quality*

A double-blind, placebo-controlled investigation evaluated the efficacy of *Passiflora incarnata* tea on sleep quality. The study looked at 41 healthy young adults using sleep diaries validated by polysomnography, and an anxiety inventory. Subjects with a history of sleep disorder were excluded. Subjects were given one cup of Passionflower or a placebo tea for one week. This was followed by a one week washout period and crossed over. Sleep quality was significantly better for those who drank Passionflower tea.<sup>14</sup>

### *Study: Passiflora Incarnata and Generalized Anxiety Disorder*

A double-blind, randomized controlled four-week study looked at 36 patients with Generalized Anxiety Disorder (GAD). Subjects were given 45 drops of passionflower extract, at 1:5. This was compared to 30mg of Oxazepam. The outcome showed that the passionflower extract was effective and better tolerated than the Oxazepam.<sup>15</sup>

### *Dosing*

Passionflower is generally regarded as safe and can be given in the following doses:

- Dried herb: 2 g, one to four times daily
- Infusion: 2 g in 150 ml water, one to four times daily
- Fluid extract 1:1 (g/ml): 2 ml, one to four times daily
- Liquid phytocap form, 2 capsules, one to four times daily
- Tincture 1:5 (g/ml): 5-10 ml, one to four times daily
- Higher doses can be given for insomnia

<sup>14</sup> Ngan A, *Phytother Res.* 2011 Aug;25(8):1153-9

<sup>15</sup> S. Akhondzadeh et al *Passionflower in the treatment of generalized anxiety: a pilot double-blind randomized controlled trial with oxazepam, Journal of Clinical Pharmacy and Therapeutics* (2001) 26, 363±367

## **American Skullcap (*Scutellaria Lateriflora*)**

American skullcap, also known as *Scutellaria lateriflora* has not been widely studied. In fact, most of the information about this plant is based on traditional and empirical information. It is widely used as an antispasmodic. It also has anti-anxiety effects and is a relaxant sedative. American skullcap is a tonic to the nervous system. It is cooling and tends to have a bitter taste.

### ***Active Constituents***

American skullcap contains volatile oil and bitter glycosides. Scutellarin is a phenolic flavone. Most phenolic flavones are antioxidant and play a role in immune function.

### ***Traditional Uses***

American skullcap is widely used in teens and children to treat anxiety, hyperactivity, sleep issues, agitation and restlessness. It can be effective in treating nervous fear associated with test taking, bad dreams or other situations. Cardiac irritability can be treated with American skullcap, particularly in situations where anxiety is accompanied by cardiac symptoms such as palpitations or drops in blood pressure.

Other uses for American skullcap include in the treatment of irritations of the central nervous system. It can also be used to help treat depression and in situations of drug or substance withdrawal.

### ***Study: Scutellarin and Blood Flow to the Brain***

A study examined the effects of Scutellarin in 634 people with cerebral embolism, cerebral thrombosis or stroke-induced paralysis. Scutellarin was found to absorb into the intestine after hydrolysis to its aglycone by bacterial enzymes. Ultimately, Scutellarin was found to improve blood flow for 88 percent of the participants in the clinical trial.

### ***Dosing***

American skullcap can be used as a tincture or in a dried herb; however, in its dried form, the herb has a high risk of being adulterated. It can be given in the following doses:

- Dried herb infusion: 1-2 g daily
- Tincture: 1:5 2-4 ml daily

### ***Contraindications and Safety***

American skullcap is generally considered safe. It has no toxicity; however, it does have a history of high risk dry plant material adulteration.

## **Chamomile Flower (*Chamomilla Recutita*)**

Chamomile is a member of the Asteraceae family. Both the flowers and essential oils of chamomile are used botanically.

### ***Active Constituents***

The active constituents of chamomile include:

- Flavonoids-apigenin, rutin, quercetin
- Coumarins-umbelliferone
- Polysaccharides-heteroglycans
- Sesquiterpene lactones-matricin, matricarin



*Figure 2*

Clinical studies indicate that chamomile tea can induce a deep sleep. It has also been shown to have sedative and mood enhancing effects when the essential oil is used in inhalation. The extract form has been found to increase T-lymphocyte rosette formation. The polysaccharides/heteroglycans have been found to demonstrate immunostimulating activity.<sup>16</sup>

### ***Therapeutic Application***

Therapeutically, particularly with young children, chamomile flowers are widely used to treat anxiety, worry, agitation and restlessness. It can be used as a tincture to treat insomnia. It can also be useful in the ulceration of gastrointestinal tract and mucous membranes in the GI tract. Diarrhea in children can be treated with a combination of chamomile and pectin.

Chamomile can be used to treat stress-related dermatitis because it can be used topically to diminish inflammation on the skin. A study looked at chamomile in relationship to the effectiveness of hydrocortisone cream. Ultimately, the chamomile was shown to be as effective as hydrocortisone.

### ***Contraindications and Safety***

Chamomile should be avoided in those who are hypersensitive to the Asteraceae or daisy family.

### ***Dosing***

Chamomile can be given in the following doses:

- Dry flower: infused 2-8 g daily
- Tincture 1:5 3-10 ml daily
- Essential oil inhalation: 5-7 drops/16 oz.

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<sup>16</sup> Braun, L. "Herbs and Natural Supplements: An evidence-based guide". Elsevier Australia 2007, 215-221

## Conclusion

Children of all ages feel the effects of stress in their ever changing physiology. In the modern world of over-achievement and highly competitive academics and sports, children feel increased stress. Herbal medicines offer several options for support to the neuro-endocrine system and aid in managing common symptoms of stress.

Botanical medicines can help children and teens with a variety of issues. Lemon balm can be used for attention, focus, cognitive function, memory, hyperactivity, restlessness, insomnia, mood elevation and anxiety. Passiflora is best used to treat insomnia and generalized anxiety. American skullcap can be used to treat depression, substance withdrawal and anxiety. Chamomile is the mildest of the four herbs. It can be combined with lemon balm for younger children and is effective at treating agitation and restlessness. Chamomile oil can also help with sedation and to elevate mood.

Evaluating both social and physiological causes of stress are crucial to correctly reducing and treating stress. Helping parents understand their role and effect on their child's stress level is an important part of the treatment plan. Selecting the appropriate botanical treatment can vastly reduce stress and improve overall quality of life for a child or teen.

## Contributor

Dr. Bove received her doctorate of naturopathic medicine and midwifery certification from Bastyr College of Nature Health Sciences in Seattle, Washington. She received her diploma of cytotherapy and herbal medicine at the School of Cytotherapy in Great Britain.

Dr. Bove practices naturopathic family medicine at the Brattleboro Naturopathic Clinic, in Brattleboro, Vermont and serves as a member of Gaia Herbs Professional Solutions Scientific Advisory Board. She is the author of *Encyclopedia of Natural Healing for Children and Infants* and the co-author of *Herbs for Women's Health*. She has been published in many magazines, journals and other collaborative books on botanical and natural medicine. She also lectures and teaches internationally.