

Aromatherapy as an integrative and complementary practice in modulating attentional focus in children and adolescents

Abstract

Attention Deficit Hyperactivity Disorder (ADHD) is one of the most prevalent neuropsychiatric conditions among children and adolescents, with a global prevalence of approximately 8.0% and a marked upward trend in diagnoses. Inattention, a core component of the symptomatic triad, substantially compromises academic performance, interpersonal functioning, and emotional well-being. Although stimulant pharmacotherapy remains the mainstay of treatment, concerns regarding adverse effects and long-term efficacy have stimulated growing interest in integrative and complementary practices. This study proposes Aromatherapy as a complementary, humanized, and low-cost strategy for modulating attentional focus in children and adolescents with ADHD. It is a narrative literature review based on national and international studies addressing essential oils and attentional processes. Preliminary evidence suggests that essential oils such as lavender (*Lavandula angustifolia*), lemongrass (*Cymbopogon citratus*), and, most notably, rosemary (*Rosmarinus officinalis*) exert anxiolytic and cognition-enhancing effects mediated by the limbic system. In the case of rosemary, the terpenes in the compound, including borneol, appear to increase dopamine and norepinephrine availability in the prefrontal cortex, supporting executive functions such as sustained attention and working memory. The study concludes that Aromatherapy constitutes a promising adjunct, rather than a substitute, for conventional treatment, warranting professional training and further methodologically rigorous research to establish the efficacy and safety of these interventions.

Keywords: attention deficit hyperactivity disorder, aromatherapy, complementary therapies, *Rosmarinus officinalis*, attention

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Lindisley Ferreira Gomides,¹ Serafyn Sampaio Mendes,² José Carlos Rodrigues Duarte,³ Célio Souto Gomes⁴

¹Professor, Master's Program in Health and Environmental Sciences (PROCISA), Faculdade Dinâmica do Vale do Piranga, Ponte Nova-MG

²Psychology student, Faculdade Dinâmica do Vale do Piranga, Ponte Nova-MG

³Medical student, Faculdade Dinâmica do Vale do Piranga, Ponte Nova-MG

⁴Chemist, Federal University of Viçosa, Viçosa-MG

Correspondence: Lindisley Ferreira Gomides, Professor, Master's Program in Health and Environmental Sciences (PROCISA), Faculdade Dinâmica do Vale do Piranga, Ponte Nova, MG, Brazil

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Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is a neuropsychiatric disorder widely prevalent among children and adolescents, affecting multiple domains of life, such as school performance, academic performance, interpersonal and professional relationships, with a consequent impact on the individual's emotional well-being.¹ Although its diagnosis preferably occurs in childhood, symptoms can persist into adulthood.²

Difficulty concentrating (or inattention) is one of the symptoms, considered part of the symptomatic triad of ADHD, along with impulsivity and hyperactivity. This symptom, in particular, brings a series of inconveniences to the individual's personal life, impairing their performance in numerous daily tasks. In children and adolescents, difficulty paying attention to classes is observed,³ or sometimes even mistakes in activities due to carelessness; lack of concentration on tasks, often without completing them; lack of understanding or active listening when it is necessary to establish a dialogue. Furthermore, there is commonly disorganization and resistance to engaging in activities that require sustained mental effort, due to a propensity for distraction.⁴ Table 1 below presents the criteria for diagnosing inattention pattern, according to the American Psychiatric Association.⁵

Recent epidemiological data draw attention to the exponential increase in the number of ADHD diagnoses. A literature review with a sample size of 588 primary studies with 3.277.590 participants demonstrated a global prevalence of ADHD in 8.0% of children and adolescents.⁶ In the United States, the proportion was 11.3% in children aged 5 to 17 years⁷ to approximately 6% of adults (15.5 million), according to the Centers for Disease Control and Prevention

(CDC) report in 2024.⁸ The scenario of the growing increase in ADHD diagnoses and their expansion to different age groups and social contexts requires reflection on how to address the symptoms and the irrational use of medications.

Table 1 Criteria for diagnosing the inattention pattern

Numbering	Criteria
1	Lack of attention to detail or makes careless mistakes
2	Difficulty sustaining attention on tasks and activities
3	Does not pay attention unless spoken to directly
4	Does not follow instructions and fails to complete tasks
5	Has difficulty organizing tasks and activities
6	Avoids or dislikes performing tasks that require prolonged mental effort
7	Loses items necessary for daily activities
8	Is easily distracted by external stimuli
9	Forgetfulness regarding daily activities

Source: Adapted from the Diagnostic and Statistical Manual of Mental Disorders - DSM-5.⁵

Currently, conventional ADHD treatment is mainly based on the use of pharmacological therapies with stimulant medications, such as methylphenidate and amphetamines, which have as their mechanism of action the indirect release of dopamine and norepinephrine in presynaptic neurons,⁹ in conjunction with psychosocial therapies.¹⁰

Although effective in the short term, the use of these psychotropic drugs has often raised important debates about the possible side effects with prolonged use and even chemical dependence in patients.

Corroborating this statement, researchers assure that these traditional pharmacological therapies available still have limitations regarding long-term effectiveness and point out that new therapeutic approaches are still under investigation.¹¹ Furthermore, such drugs also do not fully address the emotional and social needs of individuals.¹²

In order to mitigate these issues, the growing interest in integrative strategies that offer resources that can help manage symptoms and improve quality of life has led to the development and application of complementary and alternative therapies for their management.¹³

In this sense, Aromatherapy presents itself as a promising path for a holistic and less invasive treatment, with an approach centered on the individual, respecting their culture and autonomy, a more humanized and less expensive alternative to Medicine. Such care puts the patient in the position of protagonist of their own health, as it alleviates symptoms of inattention, in addition to reducing anxiety and stress, with improved sleep quality.¹⁴

Aromatherapy as a form of care for ADHD

As an ancient practice based on the use of essential oils extracted from aromatic plants, Aromatherapy has shown promise as a complementary approach in the treatment of ADHD.¹⁵ Through inhalation or topical application, the volatile compounds act directly on the Central Nervous System (CNS), stimulating the limbic system, which regulates emotions, memory and behavior.¹⁶

Studies indicate that essential oils such as lavender (*Lavandula angustifolia*), rosemary (*Rosmarinus officinalis*) and lemongrass (*Cymbopogon citratus*) have calming, anxiolytic and cognitive stimulating properties in children with the disorder. Lavender, for example, reduces anxiety and promotes relaxation; rosemary promotes alertness and improves concentration and working memory; and lemongrass acts as a mild mental stimulant.¹⁶

According to Jacob¹⁷ the therapeutic effects of Aromatherapy occur through the stimulation of the limbic system, acting directly on emotions. Each essential oil has chemical properties in its molecules, and triggers its biological effects in specific areas of the brain according to its molecular composition and affinity for the cortical area. The use of pharmaceutical forms such as mother tinctures and medicinal gummies, as explored by Garcia et al.¹⁸ also expands the possibilities of practical application of these compounds in the pediatric context.

Electroencephalographic studies indicate, for example, that lavender reduces the frequency of brain waves, promoting drowsiness and relaxation, while rosemary increases brain activity associated with wakefulness and logical reasoning. Such evidence makes Aromatherapy a viable and safe tool to assist in managing ADHD symptoms, especially when used in school and home settings, as a way to alleviate symptoms and promote benefits in daily activities.¹⁹

Neurobiological mechanism of rosemary for focus activation and self-regulation

Rosmarinus officinalis, popularly known as rosemary, is characterized by its intense and pleasant odor due to the presence of easily volatilized molecules in its leaves. The species, belonging to the *Lamiaceae* family, is found in soil rich in limestone, and its leaves are green, measuring 1.5 cm to 4.0 cm when fresh, and its flowers have blue petals.²⁰

Its phenolic compounds have antioxidant action, combating free radicals in the body,²¹ which is why rosemary has been widely used for a long time as a preservative, antifungal, and antibacterial agent. Its anti-inflammatory properties have also been used as a remedy for

liver and stomach ailments.^{20,22} In addition to phenolic compounds, the plant contains borneol, chlorogenic and rosmarinic acids, flavonoids, alpha-pinene, camphor, caffeic acid, triterpenoids and cineole,²⁰ which extends the therapeutic power of its essential oil.

Studies suggest that neurotransmitters such as dopamine and norepinephrine act on the prefrontal cortex, helping the individual to maintain focus. People with ADHD have a dysregulation of the production and/or release of these chemicals,²³ decreasing the activation time in the postsynaptic neuron, which impairs attentional focus, planning and short-term memory, functions characterized as executive functions.

Norepinephrine is a neurotransmitter that acts on the dopaminergic system and, during the day, when the sympathetic nervous system predominates, it is present in greater quantities, providing more focus than it does at night and during periods of rest and sleep.²⁴ Dopamine, in turn, is the neurotransmitter that, in addition to focus, also promotes drive and activates the reward system, which directly links it to motivation.

As such, the deficiency or dysregulation of these neurotransmitters becomes a crucial point for people with ADHD, which justifies the difficulty in maintaining attention on tasks that they do not consider important, in addition to the disinterest in continuing the task when some distracting agent interrupts the ongoing activity.²⁴

Researchers have highlighted the great capacity of terpenes for treatments and action in the prefrontal cortex and other brain regions, with borneol being a great example of a monoterpene with action in the CNS.²³ Because it has a large amount of these terpenes, rosemary tends to increase dopamine and norepinephrine levels in the body, allowing these neurotransmitters to reach their respective receptors in the post-synaptic neuron and thus trigger their biological effects, in addition to stimulating the peripheral nervous system, providing the therapeutic effect to the patient in the integral sense.²⁵ When associated with peppermint, rosemary increases disposition and improves vigor during work activities.^{26,12}

The psychotherapeutic effects of aromatherapy become especially evident when the oils are administered by inhalation, a route that allows direct action on the CNS (Figure 1).²⁷ Essential oils, due to their volatile nature, are transported by the olfactory system, allowing aromatic molecules to travel through the airways until they reach the olfactory mucous membranes. These structures have specialized receptors that, when activated, generate electrical impulses directed to the brain. In the central nervous system (CNS), these signals reach the limbic system, an area related to memories and emotional responses, triggering a series of chemical reactions capable of promoting the rebalancing of the organism, alleviating symptoms, and contributing to the treatment of various conditions, which justifies comprehensive care.

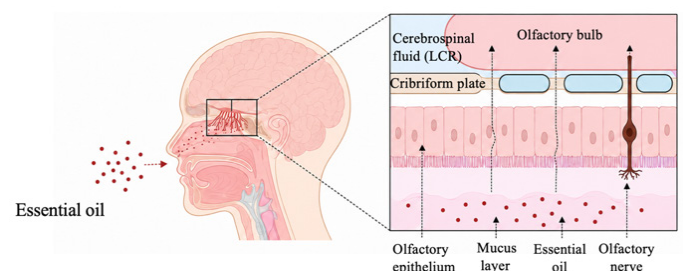


Figure 1 Olfactory pathway - Intranasal administration of essential oil.

Source: Adapted from Vora et al., 2024.²⁷

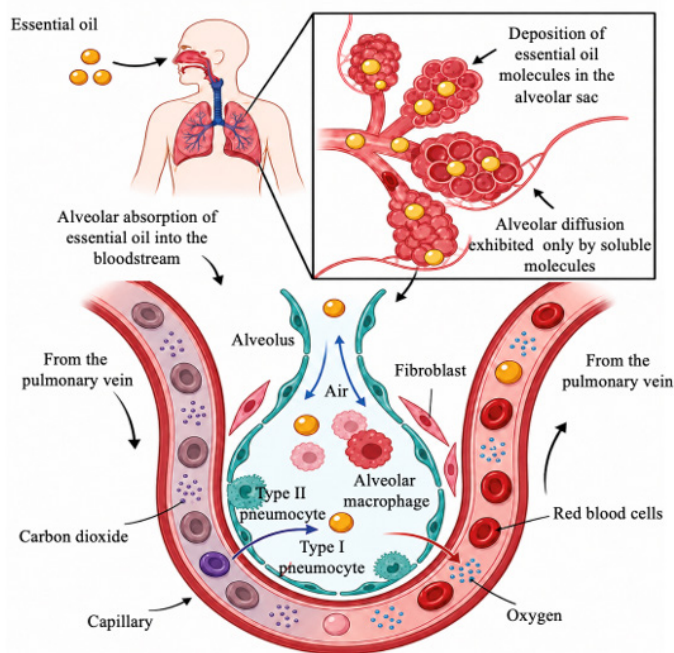


Figure 2 Intranasal administration of essential oil and its migration into the bloodstream.

Source: Adapted from Vora et al., 2024 ²⁷.

In addition to the stimulation provided by the olfactory system, another relevant pathway by which essential oils can influence brain function is absorption in the pulmonary alveoli, as illustrated in Figure 2. After being inhaled, their molecules reach the lungs and migrate into the bloodstream during gas exchange. Once in the blood, these volatile compounds have the ability to cross the blood-brain barrier (BBB), enabling their interaction with specific areas of the brain, as well as reaching other areas of the peripheral nervous system, promoting health and well-being.²⁷

Final considerations

Aromatherapy has emerged as a humanized tool for promoting health in children and adolescents with ADHD, playing an important role in modulating attentional focus, short-term memory, emotional regulation, and well-being, pointing to a therapeutic path beyond medication. In addition to lavender, which promotes relaxation, and lemongrass, with anxiolytic and cognitive properties, rosemary oil has stood out with significant results in improving inattention, one of the symptoms of the triad that characterizes ADHD, allowing for gains related to executive activities signaled by the prefrontal cortex.

However, it is necessary to emphasize that the use of essential oils should be carried out in accordance with the principles of comprehensiveness and humanized care, in a complementary way, through a broad and individual assessment of each individual, and not as a potential replacement for medication. Given this, it is important to encourage the training of health and education professionals, as well as parents and family members, for the safe and responsible use of Aromatherapy, as well as investment in more robust scientific research, with methodological designs that allow proving the effectiveness and safety of the interventions.

The well-founded and conscious inclusion of Aromatherapy in the treatment of ADHD can significantly contribute to building a

more empathetic, effective approach focused on the real needs of children and adolescents in achieving better school and academic performance, promoting interpersonal and professional relationships, impacting emotional well-being, and even considering the adult they will become in the future.

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Conflicts of interest

The author declares there is no conflict of interest.

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