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Aromatherapy: an alternative treatment for migraine headaches

Abstract

Neurological disorders are recognized as one of the leading causes of death and disability worldwide. Migraines are a neurological disorder that is often accompanied by symptoms such as pain, light and sound sensitivity, nausea, vomiting, and changes in vision. There are many challenges to managing episodic and chronic migraines. There are several non-modifiable and modifiable risk factors associated with migraine onset. Pharmacological management has been shown to be effective. Research has also shown that aromatherapy can have a positive impact on preventing and managing migraine headaches. The purpose of this mini review is to provide current data on migraines and to offer options beyond prescribed pharmaceutical medication to alleviate symptoms of this disorder. It is important to offer alternative preventative solutions to manage migraine disorders.

Keywords: migraines, headaches, aromatherapy, pain management

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Abbreviations: WHO, world health organization; ADP, adenosine diphosphate; 5-HIAA, 5-hydroxin-doleaetic acid; CGRP, calcitonin gene related peptides; cAMP, cyclic adenosine monophosphate; ATP, adenosine triphosphate; MAPK, mitogen-activated protein kinase; NF-kB, nuclear factor-kappa B; VCAM-1, vascular cell adhesion molecule-1; ICAM-1, intercellular adhesion molecule-1; JNK, c-Jun amino-terminal Kinase; BCT, behavior change wheel and taxonomy

Introduction

Neurological disorders are the world's largest disability. These include stroke, brain and other CNS cancers, spinal cord injury, traumatic brain injury, Alzheimer's disease and other dementias, Parkinson's disease, Multiple Sclerosis, tetanus, meningitis, encephalitis, neuron diseases, idiopathic epilepsy, as well as migraine headaches. Migraines are a neurological disorder that is often accompanied by symptoms such as pain, light and sound sensitivity, nausea, vomiting, and changes in vision. The World Health Organization Intersectoral Global Action Plan on Epilepsy and Other Neurological Disorders 2022–2031 (WHOiGAP) was developed by the World Health Organization (WHO) to develop an action plan to address the challenges and gaps in providing care for those with neurological disorders worldwide. The global failure to reduce the burden of neurological disorders is mainly due to the lack of effective and cost-efficient treatment available. Headache disorders are the leading causes of morbidity and disability and are associated with a multitude of comorbidities. Successful implementation of WHOiGAP will represent a revolution in neurology. This will lead to heightened public awareness of brain disorders, increased number of neurologists, enhanced research funding, and the prioritization of neurology among policy makers.[1]

The Global Burden of Disease was an investigation that examined 369 diseases and injuries in 204 countries and territories worldwide. The physical, social, and economic challenges of migraines were explored. The research revealed that most participants suffered from migraine headaches nearly half of every month. The majority of respondents diagnosed with migraine headaches indicated that it was stressful to have an unpredictable disorder and it negatively impacted their ability to take care of their family and interact with friends. Participants stated that they were less productive at work, and it has impacted their career goals and income potential. Migraine headaches were ranked as the 6th leading cause of years lost in productivity due to disability globally. Additionally, the majority of respondents wished there were more alternative treatments so they could do more to manage their disease.[2] In the United States, one in six individuals are affected by migraine headaches of the episodic or the chronic type.[3] Episodic migraines are defined as headaches occurring less than 15 days per month. Chronic migraines are defined as headaches occurring on 15 or more days per month for more than three months with at least eight days having migraine features.[4] Many people diagnosed with migraines live nearly half of every month in pain.[5] Migraine attacks are most commonly characterized by an intense, unilateral, throbbing headache with a pathophysiology that is poorly understood, poorly managed, and often leaves people disabled during attacks.[6] Annually, migraine headaches accounted for 3% of emergency department visits making it the 4th leading cause for emergency department visits.[7] Migraines are also linked with increased risk of stroke, increased white-matter hyperintensities, and structural brain lesions which have been linked with an increased risk of cognitive decline. There are several non-modifiable and modifiable risk factors associated with migraine onset. The non-modifiable risk factors include genetics, gender, and age. If one parent or both parents have migraine headaches, the risk of the child developing migraine headaches is between 40%-75%. Additionally, women are three times more likely than men to have migraines. Migraine prevalence is the highest among individuals aged 18 to 44 years old. Modifiable risk factors include medication overuse, obesity, stressful life events, specific food intake, and lack of physical activity. Migraine attacks are commonly managed by pharmaceutical medications, such as triptans and non-steroidal anti-inflammatory drugs. However, over 70% of migraine patients are not satisfied with this treatment. Individuals with migraines reported that prescribed medications tend to work only some of the time, and they are open to investigating alternative treatment options.[8]

Discussion

Migraine headaches

There are four main proposed mechanisms for the cause of migraine headaches including: 1. neurovascular hypothesis; 2. CGRP induced vasodilation; 3. trigeminal neurovascular theory; and 4. central sensitization and pain hypersensitivity. The following paragraphs

explain the importance of each mechanism. The neurovascular hypothesis posits that 5-HT1B/D, 5 HT2B, and 5-HT7 receptors cause migraines by their regulation of Dural vasodilation. Several factors such as vascular shear stress, vasoconstriction, and other cardiac abnormalities can lead to platelet activation and aggregation. Once platelets are activated, they can release platelet dense granules which have been shown to release 5-HT and adenosine diphosphate (ADP). The high concentration of 5-HT causes vasoconstriction within the Dura Mater. This vasoconstriction can sometimes cause a visual aura to occur in patients with migraines. This aura may appear as a star-like pattern in your peripheral vision, blurred vision, or spotted vision on one side of the visual field.[9] 5-HT then becomes metabolized into 5-hydroxin-doleaetic acid (5-HIAA) which is excreted through the urine. Once excreted, the plasma 5-HT levels drop which has been shown to stimulate perivascular pain fibers, release local nitric oxide and prostaglandins, and cause a resultant vasodilation. This vasodilation leads to a potential migraine attack.[10]

Calcitonin gene related peptides (CGRP) is a neuropeptide that can help to relax blood vessels.[10] Van Dongen et al.,[11] discovered the cerebral spinal fluid and serum CGRP levels in patients with migraines was significantly higher than those in healthy subjects. CGRP activates specific G protein coupled receptors which activate adenylyl cyclase. CGRP also increases the concentration of intracellular cyclic adenosine monophosphate (cAMP) and activates the cyclic adenosine monophosphate signaling pathway, thereby blocking the flow of calcium into the cell. With a lower level of calcium within the cell, calmodulin dependent myosin light chain kinase becomes inactivated.[10] This deactivation reduces the activation of adenosine triphosphate (ATP) leading to vasodilation[12] and may result in a migraine attack.

The trigeminal neurovascular theory is a multifaceted theory that analyzes the role of mitogen-activated protein kinase (MAPK) and nuclear factor-kappa B (NF-kB) in neurogenic inflammation.[13] In healthy individuals, the NF-kB phosphorylation site is blocked. But in a migraine condition or following inflammatory exposure, P50 becomes exposed which allows P65 to transfer to the nucleus. P65 can bind to the kB sites and promote inflammatory factors such as TNF-α, IL-1β, IL-6, vascular cell adhesion molecule-1 (VCAM-1), and intercellular adhesion molecule-1 (ICAM-1), and inflammatory enzymes such as iNOS and COX-2. A subfamily of MAPK termed the c-Jun amino-terminal Kinase (JNK) and p38 MAPK-mediated signaling pathways are activated by proinflammatory cytokines and inflammatory mediators,[14] which have been proven to be higher in migraine patients.[15] Once the signaling pathway is activated, JNK binds to c-Jun and phosphorylates. This promotes the expression of transcription factors that result in neuronal death such as c-jun and c-fos. The activation of the JNK pathway also upregulates the expression of COX-2 which further increases proinflammatory factors and prostaglandins which can lead to the development of pain in migraine patients.

Lastly, pain hypersensitivity has been shown in 50% to 80% of patients with migraines due to central sensitization.[16] Central sensitization is believed to be caused by neurons in the trigeminal neurovascular system.[17] The transient receptor potential channel on the trigeminal ganglion can convert thermal, chemical, and mechanical stimulation into inward currents which create impulses that can activate the TRP channel. This activation can increase the concentration of calcium and sodium ions in cells.[18] This then causes an increase in glutamate which acts on receptors to further increase calcium influx. Glutamate also produces an excitatory postsynaptic potential and maintains a sensitized state within the cells.[19] This central sensitization is usually manifested as a painful sensation to cold or heat and to pressure which can trigger migraines. Further, frequent migraines add to the allostatic load which creates further central sensitivity. Abnormal function structure and connectivity of brain regions responsible for regulating emotional response to pain and determining general affect and mood have abnormal function or structure in migraine patients. The anterior cingulate cortex, anterior insula, prefrontal cortex, hippocampus, and amygdala have a stronger functional connectivity resulting in stronger reactions physically and emotionally to painful stimuli among those who suffer from migraine headaches.[20]

Essential oil aromatherapy

Essential oil aromatherapy has been shown to either completely eliminate migraines or improve migraine pain and associated symptoms. In a meta-analysis study conducted by Yuan et al.,[10] components of specific essential oils and their proposed mechanisms for anti-migraine activity were investigated. Ten plant essential oils were analyzed for their effects on relieving migraine intensity and reducing the frequency of attack. Of the ten, lavender essential oil, peppermint essential oil, chamomile essential oil, anise essential oil, basil essential oil, rose essential oil, and mixed essential oils were associated with relieving migraine intensity and reducing attack frequency. Some other oils were also identified for helping with photophobia (sensitivity to light), phonophobia (sensitivity to sounds), nausea, vomiting, and other symptoms. Peppermint essential oil relieved all symptoms in migraine patients within five minutes of inhalation.[21] Peppermint essential oil also reduced the intensity and frequency of headaches compared to before treatment.[22] Chamomile essential oil was applied topically to the temporal and forehead areas with a gel and relieved the symptoms of pain, nausea, vomiting, photophobia, and phonophobia in migraine patients.[23] Anise essential oil was applied topically to the temporal and forehead areas and reduced the frequency of migraine attacks nearly in half every week of the month during the duration of the study.[24] Basil essential oil applied topically to the frontal and temporal lobes was shown to reduce migraine pain intensity and attack frequency.[25]

Rose essential oil when applied topically to the temporal and forehead relieved the pain intensity of patients with heat migraine syndrome which includes red eyes, photophobia, spicy taste, and facial heat during headaches.[26] Mixed essential oils with a lavender essential oil, grapeseed essential oil, and base oil when applied to the face, forehead, and back of the neck completely eliminated migraine symptoms within 20 days of continual use and showed no reoccurrence within one year. Some patients reported significantly reduced pain levels compared to before the intervention.[27]

Self-management education

Patel et al.,[8] developed and tested a self-management education support program for individuals living with chronic migraines. The researchers developed the program by conducting interviews with individuals who suffered from chronic migraines to gather opinions on what a self-management program for individuals with chronic migraines should entail. Based on the first-person perspective, the researchers developed a program based upon Miche's behavior change wheel and taxonomy (BCT). The BCT incorporates psychological, physical, social, reflective, and automatic processes which drive one's capability, opportunity, and motivation. To target these components education, persuasion, incentivization, coercion, training, restriction, environmental restructuring, modeling, and enablement can be regulated at an individual level to promote behavior change. The key

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components of this intervention were delivered over a two-day period with eight separate sessions in total. Day one focused on headache information and mechanisms, acceptance of chronic headaches, the impact of thoughts, mood and emotion on headaches, headache cycles and breaking the cycles, as well as unhelpful thinking patterns and finding alternatives. Day two focused on identifying barriers to change and exploring problem solving and goal setting, communicating better with health care professionals, and managing setbacks and what to do when things don't go according to plan.

Their research indicated a self-management education intervention was significantly useful in alleviating the pain and symptoms associated with migraine disorders.[8] Probyn et al.,[28] analyzed the effects of self-management education programs in a meta-analysis on headache related outcomes compared to usual care practices. Headache frequency, pain intensity, mood, headache related disability, quality of life, and medication consumption were all investigated. Overall, self-management education programs seemed to be more effective in improving pain intensity, headache related disability, quality of life, and medication consumption; and moderately more effective than usual care practices at improving mood compared to usual care practices. However, self-management education interventions did not improve measures relative to headache frequency. When the programs included self-management education, they were significantly more effective in improving headache related disability and pain intensity compared to programs without educational materials. When a nurse or allied health professional was included as the intervention provider, the impact had a more positive outcome on pain intensity versus when a psychologist or therapist was used as the intervention provider. These findings support the need for self-management educational programs. These programs are beneficial for global public health outcomes as well as the overall quality of life for individuals who suffer from migraine headaches.[28]

Conclusion

There are many physical, social, and economic burdens worldwide that result from experiencing neurological disorders. It is important to offer alternative treatments to manage these disorders, including migraine headaches. Inconsistent relief from traditional medical options leaves the majority of patients unsatisfied with their current treatment. The lack of satisfaction with usual care practices and the lack of self-management education signifies a need for intervention programs. Essential oils, specifically a blend of peppermint, chamomile, anise, basil, and rose essential oil have proved their healing powers by partially or fully ameliorating migraine pain and associated symptoms. Additionally, self-management educational programs have proven to improve many migraine-related outcomes including headache related disability, quality of life, mood, and medication consumption. Future programs that utilize both essential oil aromatherapy and self-management education will significantly improve migraine pain severity, migraine frequency, as well as associated migraine symptoms. The increase in the number of individuals impacted by non-communicable neurological disorders implies a need for heightened resources for the management of these disorders. Evidence of alternative options other than prescribed pharmaceutical medications for migraine headache disorders have proven to be effective to enhance overall well-being and quality of life.

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Conflicts of interest

The authors declares that there are no conflict of interest.

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