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FORMULATION AND EVALUATION OF A POLYHERBAL NASAL INHALER FOR REDUCING DIGITAL FATIGUE IN PROLONGED SCREEN USERS

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ABSTRACT

The rapid increase in digital device usage has led to a significant rise in digital fatigue, a condition commonly experienced by individuals who spend prolonged hours in front of screens such as computers, smartphones, and tablets. Digital fatigue is characterized by symptoms including eye strain, headache, mental exhaustion, reduced concentration, nasal dryness, and overall discomfort, which can negatively impact productivity and quality of life. Conventional management strategies such as artificial tears, screen breaks, and blue-light filters provide only partial relief and may not effectively address the neurological and sensory aspects associated with prolonged screen exposure. Hence, there is a growing need for safe, natural, and convenient interventions that can help alleviate digital fatigue. Polyherbal formulations have gained considerable attention in recent years due to their synergistictherapeutic effects, improved efficacy, and reduced risk of adverse reactions. Nasal inhalation therapy represents a rapid and non-invasive route of administration, allowing volatile herbal compounds to directly stimulate the olfactory receptors and influence the limbic system of the brain, which plays a vital role in regulating mood, alertness, and cognitive functions. Herbal essential oils possessing refreshing, calming, and neuroprotective properties may therefore provide potential benefits in reducing symptoms associated with digital fatigue.The present

conceptual research focuses on the formulation and evaluation of a polyherbal nasal inhaler designed to reduce digital fatigue in prolonged screen users. Selected herbal ingredients such as peppermint, eucalyptus, lavender, rosemary, and tulsi are considered based on their documented cooling, decongestant, antioxidant, and cognitive-enhancing properties. The proposed formulation aims to deliver these bioactive volatile compounds through a portable nasal inhaler device that can provide rapid sensory stimulation and mental refreshment. Furthermore, the study conceptually outlines formulation design strategies and evaluation parameters including organoleptic characteristics, aroma intensity, stability, and user acceptability. The development of such a polyherbal nasal inhaler may offer a natural, safe, and convenient approach for managing digital fatigue among students, professionals, and individuals exposed to prolonged screen time. This conceptual work may serve as a foundation for future experimental studies and clinical validation in the development of innovative herbal therapeutic products.

INTRODUCTION

The rapid advancement of digital technology has significantly transformed modern lifestyles, leading to a substantial increase in the use of electronic devices such as computers, smartphones, tablets, and televisions. In recent years, prolonged screen exposure has become common among students, office workers, and professionals, particularly in educational, occupational, and entertainment settings. While digital technologies offer numerous advantages in communication, learning, and productivity, excessive screen time has also been associated with various health concerns, one of the most prevalent being digital fatigue. Digital fatigue refers to a cluster of physical, visual, and neurological symptoms that arise due to extended exposure to digital screens. Common symptoms include eye strain, dryness or irritation of the eyes, headaches, blurred vision, mental exhaustion, reduced concentration, and discomfort around the nasal and forehead regions. Continuous exposure to blue light emitted from digital devices, along with prolonged focus on screens, contributes to visual stress and neurological overload. Over time, these effects may reduce cognitive efficiency, productivity, and overall well-being. Traditional management strategies for digital fatigue mainly involve behavioral modifications such as taking regular breaks, adjusting screen brightness, using anti-glare filters, and applying artificial tear drops. Although these approaches provide temporary relief, they may not effectively address the neurological and sensory discomfort associated with prolonged screen exposure. Therefore, there is a growing interest in exploring alternative and complementary therapies that are safe, natural, and easy

to use. Herbal medicine has been widely recognized for its therapeutic potential in promoting relaxation, improving cognitive function, and relieving stress-related symptoms. In particular, aromatic herbal compounds and essential oils possess bioactive constituents capable of stimulating the olfactory system and influencing brain activity through the limbic system, which regulates emotions, alertness, and memory. Nasal inhalation of herbal vapors allows these volatile compounds to reach the olfactory receptors rapidly, producing a refreshing and calming effect. Polyherbal formulations, which combine multiple medicinal herbs, are often preferred due to their synergistic therapeutic effects and broader pharmacological benefits. By integrating herbs with cooling, refreshing, antioxidant, and neuroprotective properties, it is possible to develop innovative formulations that may help alleviate symptoms associated with digital fatigue. In this context, the present conceptual study focuses on the formulation and evaluation of a polyherbal nasal inhaler designed to reduce digital fatigue in individuals exposed to prolonged screen usage. The proposed formulation aims to utilize selected herbal ingredients known for their refreshing aroma, cognitive enhancement, and stress-relieving properties. Such a polyherbal nasal inhaler may provide a convenient, portable, and natural approach for managing digital fatigue and improving overall mental comfort among frequent digital device users.

Digital Fatigue and Its Health Impact

Digital fatigue, often referred to as digital eye strain or computer vision syndrome, is a growing health concern associated with prolonged exposure to digital screens such as computers, smartphones, tablets, and televisions. With the increasing dependence on digital technologies for education, work, and entertainment, individuals are spending extended hours in front of screens, which has significantly increased the prevalence of digital fatigue worldwide. Studies suggest that individuals who use digital devices for more than 4–6 hours per day are at a higher risk of experiencing symptoms related to digital fatigue.

Digital fatigue is characterized by a combination of visual, neurological, and musculoskeletal symptoms. The most common symptoms include eye strain, blurred vision, dryness or irritation of the eyes, headaches, and difficulty focusing. Continuous screen exposure also reduces the natural blinking rate, leading to tear film instability and dryness of the ocular surface. In addition to ocular symptoms, many individuals report mental exhaustion, reduced concentration, and irritability due to prolonged cognitive engagement with digital content. Another important factor contributing to digital fatigue is blue light emission from digital

screens. Blue light possesses higher energy and shorter wavelengths compared to other visible light, enabling it to penetrate deeper into the eye. Excessive exposure to blue light may lead to oxidative stress in retinal cells and disrupt the circadian rhythm by suppressing melatonin production, which can negatively affect sleep quality and overall mental health. Consequently, individuals experiencing digital fatigue often report symptoms such as poor sleep, reduced alertness, and decreased productivity.

Beyond ocular discomfort, digital fatigue may also influence neurological and psychological well-being. Continuous visual focus and mental processing of digital information can lead to cognitive overload, resulting in mental tiredness and reduced attention span. Over time, this condition may affect academic performance, work efficiency, and overall quality of life.

Furthermore, prolonged screen usage often leads to poor posture, which may cause neck pain, shoulder stiffness, and headaches. These combined effects highlight the multifactorial nature of digital fatigue, involving visual stress, neurological strain, and musculoskeletal discomfort.

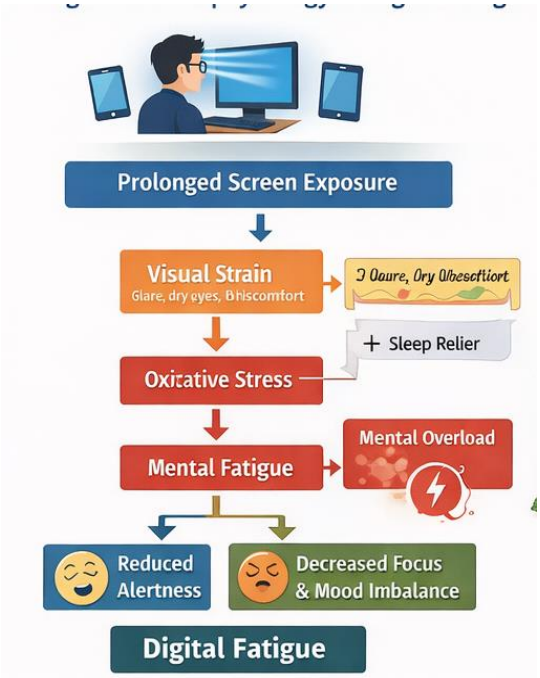
Given the increasing prevalence of digital fatigue in modern society, there is a pressing need for innovative strategies that can effectively alleviate its symptoms. Natural therapies, particularly those involving aromatic herbal compounds and nasal inhalation methods, may provide a promising approach by promoting mental relaxation, improving alertness, and reducing sensory discomfort associated with prolonged screen exposure.

Pathophysiology of Digital Fatigue

Digital fatigue develops as a result of prolonged exposure to digital screens, leading to a combination of visual stress, neurological strain, and physiological imbalance. The pathophysiology of digital fatigue involves multiple mechanisms including blue light exposure, reduced blinking rate, oxidative stress, and cognitive overload.

One of the primary factors responsible for digital fatigue is continuous visual focusing on digital screens**.** When individuals use computers or smartphones for extended periods, the eye muscles responsible for focusing, particularly the ciliary muscles, remain in a constant state of contraction. This prolonged accommodation results in ocular strain and difficulty in refocusing, which may lead to symptoms such as blurred vision, eye discomfort, and headaches. Another important mechanism is the reduction in blinking rate during screen usage. Under normal conditions, humans blink approximately 15–20 times per minute.

However, studies have shown that when individuals concentrate on digital screens, the blinking rate may decrease by nearly 50%. Reduced blinking leads to faster evaporation of the tear film, causing dryness, irritation, and inflammation of the ocular surface.



Blue light emission from digital devices also plays a significant role in the development of digital fatigue. Blue light has shorter wavelengths and higher energy, allowing it to penetrate deeper into the eye and reach the retina. Prolonged exposure to blue light can induce oxidative stress in retinal cells and contribute to visual discomfort. Additionally, blue light interferes with the secretion of melatonin, a hormone responsible for regulating the sleep–wake cycle, which may result in sleep disturbances and mental fatigue.

Apart from visual effects, digital fatigue also involves neurological mechanisms**.** Continuous exposure to digital information requires sustained cognitive processing, which may lead to mental overload and reduced concentration. The brain's limbic system, which regulates emotions, attention, and stress responses, may become overstimulated during prolonged screen use, resulting in mental exhaustion and irritability.

Furthermore, sensory discomfort associated with digital fatigue can also influence the nasal–olfactory pathways. The olfactory system is directly connected to the limbic system of the brain, which controls mood, alertness, and relaxation. Stimulation of olfactory receptors

through aromatic compounds can influence brain activity and promote mental clarity and relaxation.

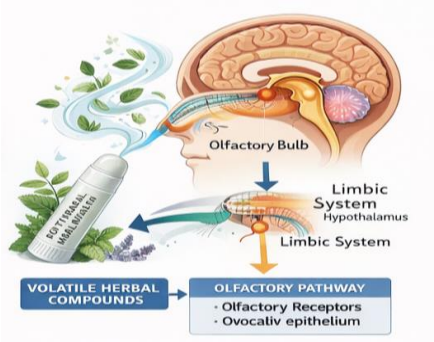
Understanding the pathophysiological mechanisms underlying digital fatigue provides a scientific basis for developing effective interventions. Herbal aromatic compounds delivered through nasal inhalation may help stimulate the olfactory pathways, reduce mental stress, and promote relaxation, thereby offering a potential supportive approach in managing digital fatigue among prolonged screen users.

Role of Aromatherapy and Nasal Inhalation Therapy

Aromatherapy is a natural therapeutic approach that utilizes volatile aromatic compounds extracted from medicinal plants, commonly known as essential oils, to promote physical and psychological well-being. For centuries, aromatic plant extracts have been used in traditional systems of medicine to relieve stress, improve mental clarity, and enhance relaxation. In recent years, aromatherapy has gained increasing scientific attention due to its potential role in managing conditions associated with stress, fatigue, and cognitive exhaustion.

One of the most effective methods of delivering aromatic compounds is through nasal inhalation. The nasal cavity contains specialized sensory receptors known as olfactory receptors, which are responsible for detecting odors. When volatile herbal compounds are inhaled, they bind to these receptors and transmit signals directly to the olfactory bulb, which is closely connected to the limbic system of the brain. The limbic system plays a crucial role in regulating emotions, memory, mood, and alertness. As a result, inhalation of certain aromatic compounds can influence brain activity and promote relaxation, mental refreshment, and improved concentration.

In the context of digital fatigue, aromatherapy may provide several beneficial effects. Aromatic compounds with cooling, refreshing, and calming properties can help reduce symptoms such as headaches, mental exhaustion, and lack of focus that commonly occur after prolonged screen exposure. For example, essential oils derived from herbs such as peppermint, eucalyptus, lavender, and rosemary are known to possess stimulating, stress-relieving, and neuroprotective properties that may support cognitive performance and mentalclarity.



Nasal inhalers offer a convenient and portable delivery system for aromatherapy. These devices typically consist of a small inhaler tube containing a wick or absorbent material impregnated with aromatic herbal oils. When the user inhales through the nose, the volatile compounds are released and reach the olfactory receptors almost instantly, producing a rapid refreshing effect. Compared to oral medications, nasal inhalation therapy offers several advantages including faster onset of action, ease of administration, and minimal systemic side effects.

Furthermore, the use of polyherbal combinations in aromatherapy may enhance therapeutic outcomes through synergistic interactions among different plant constituents. By combining herbs with complementary properties such as cooling, relaxing, and cognitive-enhancing effects, it is possible to develop an effective nasal inhaler formulation that may help reduce symptoms of digital fatigue.

Therefore, aromatherapy delivered through nasal inhalation represents a promising natural approach for promoting mental relaxation and improving sensory comfort in individuals exposed to prolonged screen usage. This concept forms the scientific basis for developing a polyherbal nasal inhaler as a supportive intervention for managing digital fatigue.

Concept of Polyherbal Formulation

Polyherbal formulations refer to therapeutic preparations that contain two or more medicinal herbs combined in a single formulation to achieve enhanced pharmacological effects. This concept has been widely practiced in traditional systems of medicine such as Ayurveda, Siddha, and Traditional Chinese Medicine, where multiple herbs are combined to produce synergistic therapeutic actions and improve overall efficacy. The principle behind polyherbal therapy is that different herbs may target multiple biological pathways simultaneously,

thereby providing a broader and more effective therapeutic outcome compared to single-herb formulations.

One of the major advantages of polyherbal formulations is synergism, where the combined action of several plant constituents produces a greater therapeutic effect than individual components alone. Each herb contributes specific pharmacological properties such as antioxidant, anti-inflammatory, neuroprotective, or relaxing effects. When these herbs are combined in appropriate proportions, they can complement and enhance each other's activity, leading to improved therapeutic performance.

Polyherbal formulations also help in reducing potential side effects. In many cases, certain herbs in the combination can counterbalance the undesirable effects of others while maintaining the desired therapeutic activity. This balanced approach is one of the reasons why traditional herbal formulations have been widely accepted as safe and effective for long-term use.

In the context of digital fatigue, a polyherbal formulation can be particularly beneficial because the condition involves multiple physiological factors, including visual strain, mental exhaustion, stress, and sensory discomfort. A combination of herbs with cooling, refreshing, antioxidant, and cognitive-enhancing properties may help address these different aspects simultaneously. For instance, some herbs may promote mental alertness, while others may provide calming or stress-relieving effects, thereby helping to restore cognitive balance.

Another important advantage of polyherbal formulations is the presence of diverse bioactive phytochemicals such as terpenoids, flavonoids, phenolic compounds, and essential oils. These compounds exhibit various pharmacological activities including antioxidant, neuroprotective, and anti-stress effects, which are relevant in managing digital fatigue caused by prolonged screen exposure.

In the development of a polyherbal nasal inhaler, combining aromatic herbs with complementary therapeutic properties can enhance the overall refreshing and relaxing effect through the olfactory pathway. The inhalation of these herbal volatile compounds may stimulate the olfactory receptors and influence the limbic system of the brain, thereby improving alertness, reducing mental fatigue, and promoting relaxation.

Thus, the concept of polyherbal formulation provides a strong scientific foundation for designing innovative herbal products. By carefully selecting and combining suitable medicinal herbs, it is possible to develop an effective and natural nasal inhaler formulation aimed at alleviating symptoms associated with digital fatigue in prolonged screen users.

Selection of Herbal Ingredients

The selection of suitable herbal ingredients plays a crucial role in the development of an effective polyherbal nasal inhaler intended for reducing digital fatigue. Medicinal plants containing volatile aromatic compounds, essential oils, and neuroactive phytochemicals are particularly beneficial for nasal inhalation therapy. These compounds can stimulate the olfactory receptors and influence the limbic system of the brain, thereby promoting mental alertness, relaxation, and relief from sensory fatigue.

For the proposed polyherbal nasal inhaler, herbs were conceptually selected based on their cooling, refreshing, antioxidant, and cognitive-enhancing properties. The following medicinal herbs are considered potential candidates for the formulation.

Peppermint (*Menthapiperita*)

Peppermint is widely known for its cooling and refreshing aroma due to the presence of menthol and menthone. These compounds exhibit stimulating effects on the sensory nerves and help relieve headaches, mental fatigue, and nasal congestion. Peppermint inhalation is also known to improve alertness and cognitive performance.

Eucalyptus (*Eucalyptus globulus*)

Eucalyptus essential oil contains the active compound eucalyptol (1,8-cineole), which possesses strong aromatic and decongestant properties. It helps clear the nasal passages, improves breathing comfort, and produces a refreshing sensation that may reduce mental fatigue and enhance concentration.

Lavender (*Lavandula angustifolia*)

Lavender is widely used in aromatherapy for its calming and stress-relieving effects. Its essential oil contains compounds such as linalool and linalyl acetate that promote relaxation, reduce anxiety, and improve sleep quality. In the context of digital fatigue, lavender may help relieve mental tension and promote emotional balance.

Rosemary (*Rosmarinus officinalis*): Rosemary essential oil contains bioactive compounds such as cineole and camphor, which are known to stimulate cognitive activity and improve memory and focus. Aromatic inhalation of rosemary has been associated with improved mental clarity and alertness.

Tulsi (*Ocimum sanctum*)

Tulsi, also known as holy basil, possesses strong antioxidant, adaptogenic, and neuroprotective properties. Its aromatic constituents may help reduce stress, improve mental resilience, and support overall neurological health.

The combination of these herbs in a polyherbal formulation may produce synergistic therapeutic effects, where cooling, refreshing, relaxing, and cognitive-enhancing properties work together to alleviate symptoms associated with digital fatigue. The volatile phytochemicals present in these herbs can be effectively delivered through nasal inhalation, allowing rapid stimulation of the olfactory system and promoting mental refreshment.

Thus, careful selection and combination of medicinal herbs with complementary pharmacological properties form the basis for the development of an innovative polyherbal nasal inhaler aimed at managing digital fatigue in prolonged screen users**.**

Mechanism of Action of the Polyherbal Nasal Inhaler

The therapeutic effect of a polyherbal nasal inhaler in reducing digital fatigue is primarily mediated through the olfactory and limbic system pathways. The nasal cavity serves as a direct route for volatile herbal compounds to reach the brain, bypassing the gastrointestinal system and achieving rapid onset of action. The proposed mechanism involves multiple physiological and neurological processes.

1. Olfactory Stimulation

When volatile compounds from the poly herbal formulation are inhaled, they bind to olfactory receptors located in the nasal epithelium. These receptors are connected to the olfactory bulb, which processes odour signals and transmits them to various brain regions, including the limbic system and hypothalamus. This direct neural connection allows herbal compounds to modulate emotional states, alertness, and stress responses almost immediately.

2. Limbic System Activation

The limbic system regulates mood, memory, and cognitive functions. Aromatic compounds such as menthol (from peppermint), cineole (from eucalyptus and rosemary), and linalool (from lavender) interact with the limbic system to produce calming, refreshing, and alertness-enhancing effects. This reduces mental fatigue, enhances concentration, and alleviates the psychological components of digital fatigue.

3. Neuroprotective and Antioxidant Effects

Many herbal essential oils possess antioxidant and neuroprotective properties. Oxidative stress induced by prolonged screen exposure can lead to cellular damage in neurons and retinal cells. Compounds such as eucalyptol, linalool, and tulsi phytochemicals help neutralize free radicals, thereby reducing neurological strain and sensory discomfort.

4. Nasal Decongestion and Respiratory Comfort

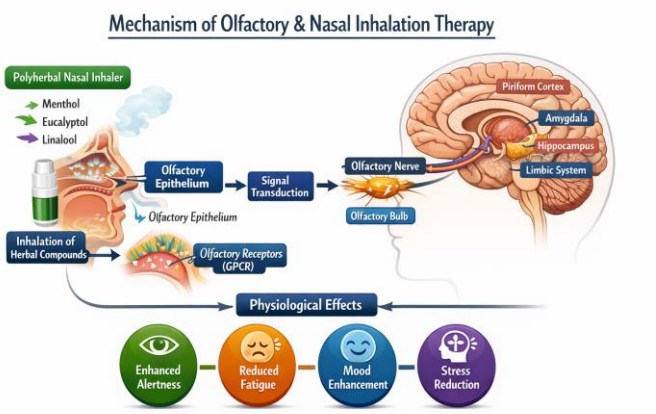
Eucalyptus and peppermint oils also contribute to nasal decongestion and improved airflow, which enhances oxygen supply to the brain. Improved respiration and oxygenation help reduce physical fatigue and promote alertness during prolonged screen use.

5. Cognitive Enhancement

Rosemary and peppermint essential oils are associated with improved memory, focus, and attention. Inhalation of these compounds can stimulate the central nervous system, facilitating better mental performance and mitigating symptoms of cognitive overload caused by digital fatigue.

6. Synergistic Effect of Polyherbal Combination

The combination of multiple herbs in the nasal inhaler creates a synergistic effect, where relaxing, stimulating, and antioxidant properties act together. This integrated approach addresses the multifactorial nature of digital fatigue, including visual strain, mental exhaustion, and stress. Overall, the polyherbal nasal inhaler functions as a natural, non-invasive intervention that simultaneously targets neurological, cognitive, and sensory aspects of digital fatigue. Its rapid action through the olfactory route, combined with the complementary effects of multiple herbs, makes it a promising therapeutic option for individuals experiencing prolonged screen-induced fatigue.



Formulation Design of the Polyherbal Nasal Inhaler

The development of a polyherbal nasal inhaler involves careful selection of ingredients, preparation of the herbal blend, and optimization of the delivery system to ensure efficacy, safety, and user acceptability. Conceptually, the formulation design includes the following steps.

1. Selection of Base and Carrier

The base of the nasal inhaler typically consists of a neutral carrier oil such as fractionated coconut oil or sesame oil, which acts as a solvent for the essential oils and ensures controlled release. The carrier must be non-irritating to the nasal mucosa and stable under storage conditions.

2. Preparation of Herbal Oil Blend

Essential oils and extracts from selected herbs such as peppermint, eucalyptus, lavender, rosemary, and tulsi are blended in precise ratios. The concentration is optimized to provide

effective olfactory stimulation without causing irritation or overpowering aroma. The blend is often filtered to remove impurities and ensure homogeneity.

3. Impregnation into Inhaler Device

The herbal blend is absorbed into a wick or absorbent core placed inside a small nasal inhaler tube. This wick allows controlled diffusion of volatile compounds upon inhalation. The device design ensures portability, ease of use, and minimal loss of active aroma during storage.

4. Packaging and Storage

The nasal inhaler is sealed in air-tight containers to preserve the volatile oils and prevent oxidation. Proper labeling includes usage instructions, storage conditions, and safety precautions. Storage in a cool, dark place helps maintain stability and efficacy over time.

5. Optimization of Aroma and User Experience

The intensity of the aroma, ease of inhalation, and immediate sensory effect are critical parameters for user acceptance. Formulators may adjust the ratio of essential oils or use mild fixatives to prolong fragrance duration while maintaining therapeutic effect.

6. Conceptual Advantages of the Formulation Design

- **Portable and convenient**: easy to carry and use at any location.
- **Non-invasive**: no oral ingestion or systemic absorption required.
- **Rapid onset of action**: direct stimulation of olfactory receptors ensures quick mental refreshment.
- **Customizable**: proportions of herbal oils can be adjusted for specific effects such as alertness, relaxation, or decongestion.

This conceptual formulation design ensures that the polyherbal nasal inhaler can deliver therapeutically active volatile compounds efficiently and safely, providing a practical and natural solution for managing digital fatigue in prolonged screen users.

Evaluation Parameters of the Polyherbal Nasal Inhaler

The effectiveness and quality of a polyherbal nasal inhaler can be conceptually assessed using several evaluation parameters. These parameters ensure that the formulation is safe, stable, and acceptable to users, while maintaining its therapeutic efficacy.

1. Organoleptic Properties

Organoleptic evaluation involves assessing color, texture, aroma, and appearance of the nasal inhaler. The aroma should be pleasant, refreshing, and consistent with the selected herbal oils. Any change in color or texture over time may indicate degradation of active components.

2. Aroma Intensity Test

A quantitative or semi-quantitative assessment of aroma intensity can be performed using sensory panels. Users inhale the product and rate the strength of the fragrance. The aroma should be strong enough to provide mental refreshment but not overpowering or irritating to the nasal mucosa.

3. pH Compatibility

The formulation's pH is critical for nasal mucosa safety. Ideally, the nasal inhaler should have a neutral to slightly acidic pH (5.5–6.5) to prevent irritation and maintain mucosal integrity.

4. Stability Study

The stability of volatile herbal compounds is assessed under various storage conditions (temperature, light, and humidity). Properly formulated nasal inhalers should retain their aromatic potency, color, and efficacy over the intended shelf life. Conceptual stability studies may include monitoring aroma intensity and physical characteristics over time.

5. User Acceptability and Sensory Evaluation

A small volunteer-based assessment can conceptually evaluate user satisfaction, ease of inhalation, and immediate effect on mental alertness or relaxation. Feedback can guide optimization of herbal ratios, aroma intensity, and inhaler design.

6. Safety Considerations

Although nasal inhalers are generally non-invasive, conceptual evaluation should include assessment of nasal irritation, allergic reactions, and overall tolerability. Herbs should be selected to minimize potential adverse effects.

7. Synergistic Efficacy Assessment

Even in conceptual research, it is important to consider the combined effect of multiple herbs. The synergistic impact on mental alertness, cognitive performance, and relaxation can be hypothesized based on documented pharmacological properties of the selected herbal oils.

Advantages of Polyherbal Nasal Inhaler for Digital Fatigue

The polyherbal nasal inhaler presents several conceptual advantages as a natural intervention for managing digital fatigue in prolonged screen users.

1. **Rapid Onset of Action**

Inhalation of volatile herbal compounds directly stimulates the olfactory system and limbic pathways, providing immediate sensory and mental refreshment compared to oral interventions.

2. **Non-Invasive and Convenient**

The nasal inhaler is easy to use, portable, and does not require ingestion, making it suitable for use in offices, classrooms, or during travel.

3. **Synergistic Herbal Action**

Combining multiple herbs allows for complementary therapeutic effects, such as cognitive enhancement, stress relief, antioxidant activity, and mental relaxation, addressing multiple aspects of digital fatigue simultaneously.

4. **Minimal Side Effects**

As a natural herbal product administered via the nasal route, it is less likely to cause systemic adverse effects compared to oral pharmacological interventions.

5. **Customizable Formulation**

Herbal ratios can be adjusted to emphasize different effects, such as alertness, relaxation, or decongestion, allowing for personalized therapeutic benefits.

6. **Portable and User-Friendly Design**

Compact inhaler devices ensure the product can be used anywhere and anytime, making it a practical solution for frequent screen users.

Future Perspectives and Research Scope

The conceptual development of a polyherbal nasal inhaler opens several avenues for future research.

1. **Clinical Evaluation**

Conduct controlled studies to measure reduction in digital fatigue symptoms, cognitive performance improvement, and user satisfaction in real-life prolonged screen users.

2. **Standardization of Herbal Ingredients**

Develop quality control parameters for volatile compounds to ensure consistent aroma, potency, and efficacy.

3. **Optimization of Polyherbal Ratios**

Explore synergistic combinations of herbs to maximize cognitive enhancement and relaxation effects.

4. **Extended Shelf-Life and Stability Studies**

Investigate methods to prolong aroma stability and bioactive compound preservation, including natural fixatives and optimized packaging.

5. **Commercial Development**

Translate the concept into a marketable product, ensuring regulatory compliance, user safety, and attractive design.

6. **Integration with Digital Wellness Programs**

Incorporate the inhaler into digital wellness initiatives, promoting holistic strategies for managing screen-related stress and fatigue

CONCLUSION

Digital fatigue is a prevalent and multifactorial condition resulting from prolonged screen exposure, affecting visual comfort, cognitive performance, and overall well-being. Conventional interventions often provide limited relief, highlighting the need for innovative, natural approaches.

The conceptual design of a polyherbal nasal inhaler leverages the synergistic effects of selected aromatic herbs such as peppermint, eucalyptus, lavender, rosemary, and tulsi, delivering refreshing, relaxing, and cognitive-enhancing effects through the olfactory pathway. Its non-invasive, portable, and rapid-acting nature makes it a promising intervention for prolonged screen users.

Evaluation of organoleptic properties, aroma intensity, stability, and user acceptability ensures safety, effectiveness, and user compliance. Future research, including clinical validation and standardization, can further establish its potential as a novel herbal solution for managing digital fatigue, providing an innovative contribution to both herbal therapeutics and digital wellness strategies.

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