

# Managing Anxiety and Hyperactivity with Biofeedback, Neurofeedback, and Integrated Approaches to Improve Body Composition

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## Abstract

Frenzy and hyperactivity are common states in modern society, often linked to dysfunctions of the Central Nervous System (CNS) and conditions such as overweight or obesity [1-5]. These states are exacerbated by a social context increasingly oriented toward productivity and speed, imposing constant stimuli and pressures. This study proposes an innovative weight-loss protocol based on biofeedback and neurofeedback, integrated with bioimpedance analysis and strategies to optimize circadian rhythms. The article provides a critical review of the literature on the role of the CNS in daily habits, the influence of chronic stress, and the effectiveness of feedback technologies.



The image is for illustrative purposes only; it was created using an artificial intelligence program and may contain inaccuracies or errors.

**Keywords:** Biofeedback, Neurofeedback, Anxiety, Hyperactivity, Central Nervous System (CNS), Chronic Stress, Weight Loss, Circadian Rhythms, Bioimpedance Analysis, Emotional Regulation, Heart Rate, Brain Waves, Cortisol, Metabolism, Personalized Interventions, Advanced Technologies, Self-Regulation, Anxiety Reduction, Healthy Lifestyle, Body Composition

## 1. Introduction

Frenzy and hyperactivity are conditions often observed in high-pressure environments, where the autonomic nervous system (ANS) plays a crucial role in regulating the stress response. These conditions can manifest as difficulties in concentration, hyperactivity to external stimuli, and a constant sense of urgency (ibidem). These factors negatively affect physical and mental well-being, leading to an overload of the nervous system. Recent

studies indicate that ANS hyperactivation is linked to a higher incidence of overweight and obesity [1]. Such hyperactivation alters metabolic regulation, promoting lipogenesis and reducing the body's ability to burn calories [6]. Additionally, chronic stress has been associated with elevated cortisol levels, which encourage visceral fat accumulation and reduce insulin sensitivity. The link between anxiety, frenzy, and difficulties in weight management highlights the need for targeted interventions involving the

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CNS. This study proposes the combined use of biofeedback, neurofeedback, bioimpedance analysis, and circadian rhythm interventions to create a personalized and effective weight-loss protocol. Furthermore, it explores how these technologies can positively influence eating behavior and adherence to a healthy lifestyle.

## 2. Methodology

### 2.1 Biofeedback and Neurofeedback

Biofeedback allows monitoring and regulation of unconscious physiological processes, such as heart rate, breathing, peripheral temperature, muscle tension, sweating (conductance), and respiratory cycles [7]. Through biofeedback, patients learn to voluntarily control otherwise automatic bodily functions, promoting a state of physiological balance. For example, an increase in respiratory cycles per minute is associated with greater activation of the sympathetic nervous system, often related to stress [8-12]. Conversely, slow, deep breathing can stimulate the parasympathetic system, fostering relaxation and stress reduction. Neurofeedback, on the other hand, focuses on brain activity measured through electroencephalography (EEG). Different brainwave frequencies, such as beta, alpha, and theta waves, reflect various emotional and cognitive states. For example, excessive beta wave activity is often associated with anxiety-related behaviors and cortical hyperactivation. Neurofeedback training can help regulate these neural patterns, promoting more balanced and less reactive mental states [13]. The combined use of biofeedback and neurofeedback leverages neuroplasticity principles to help patients achieve optimal relaxation states and improve emotional and behavioral regulation [14-18].

### 2.2 Circadian Rhythms and Light Management

A key element of the protocol is optimizing circadian rhythms through light exposure management. Synchronizing circadian rhythms is essential for regulating the release of hormones such as cortisol and melatonin, which influence sleep and metabolism [19].

- **Reducing Artificial Evening Light:** the use of low-intensity, warm-toned lights in the evening is recommended to minimize interference with melatonin production [20].
- **Maximizing Daylight Exposure:** morning exposure to natural light stimulates cortisol release and helps regulate the biological clock [21].
- **Sleep Routine:** establishing regular sleep and wake times, supported by relaxation techniques learned through biofeedback [22].

### 2.3 Bioimpedance analysis

Bioimpedance analysis is an essential tool for monitoring body composition, providing precise data on fat mass, lean mass, and total body water [23]. This data is fundamental for personalizing weight-loss protocols and evaluating the intervention's effectiveness over time.

Additionally, it allows for monitoring physiological changes, such as hydration and muscle quality, which can be influenced by high

stress levels [24]. Dehydration can further activate the nervous system and increase susceptibility to stress [25,26].

## 3. Protocol Design

- **Initial Evaluation:** a thorough diagnostic phase includes monitoring brain activity through EEG, analyzing body composition via bioimpedance analysis, and collecting anamnesis data to identify primary stressors.
- **Biofeedback and Neurofeedback Sessions:** two weekly sessions for 8 weeks, aimed at regulating heart rate, modulating brainwave activity, and improving bodily awareness.
- **Circadian Rhythm Optimization:** integration of strategies to improve daylight exposure and reduce evening exposure to artificial light.
- **Behavioral Education:** individual or group sessions to improve eating behavior, manage stress, and promote a balanced lifestyle.
- **Continuous Monitoring:** monthly progress checks using bioimpedance analysis and protocol adjustments based on the results. Continuous monitoring also helps prevent relapses and consolidate outcomes.

## 4. Clinical Case Example and Practical Protocol Application

### Clinical Case

A 45-year-old man with a body mass index (BMI) of 31 kg/m<sup>2</sup> and symptoms of generalized anxiety underwent an initial evaluation. Biofeedback sessions revealed elevated respiratory cycles (20/min), low peripheral temperature (32.5°C), and increased muscle tension in the neck and shoulders. EEG used for neurofeedback showed high beta waves (>20 Hz) in the frontal areas, indicative of excessive anxiety-related activity (Hammond, 2019). Bioimpedance analysis indicated 32% body fat and moderate dehydration.

## 5. Intervention

### 5.1 Nutritional Integration Based on Scientific Evidence

- Suggested targeted supplements include L-theanine, magnesium, and vitamin B6, known for their positive effects on reducing anxiety and improving central nervous system functioning. L-theanine has been shown to increase alpha wave production, promoting relaxation without sedation; magnesium regulates nervous activity and reduces stress; vitamin B6 supports neurotransmitter synthesis, reducing the effects of chronic stress [24].
- Specific probiotics were utilized to modulate the gut-brain axis, enhancing mood and appetite regulation (ibidem).

### 5.2 Biofeedback and Neurofeedback Sessions

- **Biofeedback:** Techniques such as diaphragmatic breathing were used to reduce respiratory cycles to 6 per minute, supported by a breathing exercise app for home use [7]. A device was provided to monitor peripheral temperature and raise it to normal levels (34-36°C).
- **Neurofeedback:** Training of alpha waves in the frontal regions to promote relaxation and reduce anxiety-triggering beta wave activity [4].

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### 5.3 Dietary Modifications

- Introduced a diet rich in fiber, lean proteins, and healthy fats to stabilize blood glucose and reduce emotional eating [27].
- Supplementation with magnesium and omega-3 to reduce sympathetic nervous system activity and promote neuroplasticity [23].

### 6. Lifestyle and Circadian Rhythms

- Morning exposure to sunlight for at least 20 minutes daily to regulate circadian rhythms.
- Reduction of blue light exposure and electronic devices in the evening; recommendations for warm lighting and relaxing reading before bed.

#### 6.1 At-Home Exercises

Daily practice of slow breathing using a dedicated app (6 cycles per minute for 10 minutes) to stimulate the vagus nerve and promote deep relaxation [7].

#### 6.2 Expected Results

Within eight weeks, a reduction in anxiety symptoms (lower beta wave activity), improvement in body composition (5-7% reduction in fat mass), and better metabolic balance are expected. The patient reports improved sleep quality and increased daytime energy.

#### 6.3 Improvements in CNS Regulation

The combined use of biofeedback and neurofeedback enhances autonomic nervous system regulation, reduces cortisol levels, and promotes relaxation [28]. A more balanced CNS also fosters greater resilience to daily stressors.

#### 6.4 Weight Loss

Reducing chronic stress supports better metabolic balance, increasing the body's ability to utilize fat as an energy source [27]. Additionally, improved awareness of eating habits decreases the likelihood of emotional eating episodes.

#### 6.5 Circadian Rhythm Optimization

Improved circadian rhythms, through optimal light exposure and a regular sleep routine, contribute to better hormonal regulation and deeper sleep, indirectly improving weight management and overall well-being.

#### 6.6 Anxiety Reduction

Modulating brainwaves through neurofeedback significantly reduces anxiety symptoms, improving quality of life and adherence to the protocol [13]. This also results in greater commitment to healthy behaviors and a reduction in relapses.

### 7. Discussion

The presented protocol integrates advanced technologies to address the challenges of weight management in anxious individuals by leveraging the connection between the CNS and metabolism. ANS hyperactivity and elevated chronic stress levels represent significant risk factors for overweight conditions, as they disrupt hormonal and metabolic regulation [1]. Bioimpedance

analysis provides objective monitoring, while biofeedback and neurofeedback directly address the neurological and physiological causes of the problem. The inclusion of circadian rhythm interventions adds an innovative element to improving sleep quality and metabolic regulation. The combination of these technologies enables targeted and personalized interventions, offering a holistic approach that considers the physical and emotional needs of the patient. Additionally, literature highlights that biofeedback and neurofeedback-based interventions can also be applied to other related conditions, such as insomnia, hypertension, and mood disorders, expanding the potential of these tools [7].

### 8. Limitations and Final Considerations

While the proposed approach integrates innovative techniques and is supported by a solid theoretical foundation, we acknowledge that results and effectiveness may vary significantly among individuals. Factors such as age, gender, pre-existing health conditions, and genetic or environmental differences can influence the impact of biofeedback, neurofeedback, bioimpedance analysis, and the suggested supplements. Furthermore, the ability to implement strategies for optimizing circadian rhythms may be limited by occupational, personal, or social constraints. Monitoring techniques, such as bioimpedance analysis, though useful, may present margins of error in specific clinical contexts, such as altered hydration states or severe obesity. Therefore, we emphasize the importance of tailoring each intervention to the specific needs of the individual through personalized assessment and continuous monitoring. This awareness allows us to propose a holistic yet flexible approach that can be adapted to meet the diverse needs of the population. Further research aimed at testing the efficacy of these solutions in different population subgroups represents the next step in consolidating the scientific foundation of this model.

### 9. Conclusions

This study highlights the importance of integrated approaches for managing overweight and anxiety. The combined use of biofeedback, neurofeedback, circadian rhythm optimization, and bioimpedance analysis represents an innovative and promising strategy for improving physical and mental health. Recent studies further support the effectiveness of these technologies. For example, Thompson et al. demonstrated that neurofeedback can significantly reduce anxiety symptoms, improving emotional regulation and promoting a state of relaxation. Additionally, Czeisler et al. highlighted the importance of circadian rhythm synchronization in metabolic regulation and stress management [7,19]. The integration of objective data, such as that provided by bioimpedance analysis, with personalized interventions enhances the overall effectiveness of the protocol and ensures its sustainability in the long term.

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