Substances that facilitate lucid dreaming – A Case Study

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Abstract

A test matrix utilizing six different supplements: galantamine, huperzine A, nicotine, bupropion, propranolol, and an amino acid blend was used to show that lucid dreams are strongly facilitated when two neurochemical events take place simultaneously: (1) dopaminergic and adrenergic stimulation coupled with (2) cholinergic and/or glutamateric stimulation.

The substances were chosen due to their different pharmacological properties and several combinations resulted in lucid dreams 100% of the time. The two most successful combinations were galantamine/propranolol and the amino acid blend however other combinations also led to very high success rates: huperzine/bupropion, galantamine/nicotine, and huperzine/nicotine.

The summary of this work indicates that vivid dream states can be induced using cholinergic, glutamateric, dopaminergic, and adrenergic stimulation either independently or in various combinations, which in turn leads to an increase in odds of inducing a lucid dream. However, when dopaminergic and adrenergic stimulation occurs simultaneously with cholinergic and/or glutamateric stimulation, there is a significant increase in lucid dream facilitation. The role of melatonin as it relates to galantamine's effectiveness is also discussed.

Introduction

Lucid dreams are defined as being aware that you are dreaming while within a dream. They are a specific state of consciousness characterized by consciously perceiving and recognizing that you are in a dream while you are sleeping.

Although several theories exist that try to explain the neurochemical origins of ordinary dreams, little work has been done to create a cohesive theory for the neurological basis of lucid dreams. I suggest that because lucid dreams offer such a unique potential in exploring the inner-workings of the human mind and because of the many therapeutic benefits and/or psychological ramifications they possess, that understanding the brain chemistry behind lucid dreaming could lead to substantial advancements in the fields of psychology and cognitive neuroscience, as well as a deepening in the understanding of human consciousness. This paper presents, for the first time, a cohesive and experimentally supported model describing the neurochemical events required to induce lucid dreams.

Background

With the advancements in the fields of neuroscience and pharmacotherapy, it has become increasingly clear that vivid dreams as well as lucid dreams can be described in terms of specific neurochemical events that take place within the brain. Various drugs have been shown to have a direct impact on both states. In the paper “Drug Induced Nightmares” [6], the authors describe how specific drugs, acting via different neurological pathways, can all lead to vivid dream states and/or nightmares. Their paper reveals that dreams can be induced by specific neurochemical events taking place within

the brain. Furthermore, it appears that vivid dreams can be correlated with changes in any of a number of different neurotransmitter levels (dopamine, norepinephrine, acetylcholine, etc) within the brain.

There have also been published reports of specific drugs facilitating lucid dreaming; the most notable being Galantamine [10]. Since this particular lucid dream supplement (LDS) is considered to be a cholinergic drug, it could be mistakenly assumed that cholinergic action is the primary driving force behind lucid dreaming. In fact however, lucid dreaming requires a delicate balance of multiple brain chemicals. By more carefully studying the action of galantamine, it becomes evident that dopamine, norepinephrine, serotonin, and melatonin, in addition to acetylcholine, all play important roles in supporting lucid dreaming. By better understanding the mechanism of lucid dream induction, more and potentially better pharmacological options become available to facilitate them.

Hypothesis

Lucid dreams occur as a result of an increase in dopaminergic and adrenergic stimulation coupled with a state of cerebral activation that occurs via either cholinergic stimulation, glutamateric stimulation, or both.

Galantamine is a unique drug that is primarily used to counter some of the early symptoms of Alzheimer's disease. It has been shown to possess modest acetylcholinesterase (AChE) inhibiting ability (increasing both the level and duration of action of the neurotransmitter acetylcholine (ACh)); to be an allosteric potentiator of the α7, α4β2, and α3 nicotinic receptor subtypes (sensitizing the nicotinic receptors in order

to get an increased response for a given input); to be a partial nicotinic agonist (directly binding to the α4β2-type nicotinic receptors), and to be a modulator of neurotransmitter release (primarily resulting in the release of dopamine (DA) and norepinephrine (NE) within various brain regions via enhanced nicotinic stimulation) [9]. It has also been shown to be an extremely effective lucid dream inducing supplement when used according to the correct procedure [10].

It seems likely then that galantamine's effectiveness at inducing lucid dreams is not due to general cholinergic stimulation but rather due to a more specific nicotinic cholinergic stimulation which results in a state of cerebral activation coupled with the release of both dopamine and norepinephrine into various brain regions. My research has not only shown that this is in fact the case, but also that a variety of mechanisms are available that can lead to the same result: the facilitation of lucid dreams.

Nicotinic stimulation results in the release of dopamine and norepinephrine [2]. There are however alternative approaches available to increase dopaminergic and adrenergic activity: reuptake inhibitors, specific agonists, antagonists, breakdown inhibitors, precursors, and other releasing agents. In this paper, the focus is on reuptake inhibitors and releasing agents.

My research has revealed that lucid dreams are facilitated by increases in dopaminergic and adrenergic activity and that this increase can be achieved using the following strategies:

- Increased DA and NE release via nicotinic receptor stimulation
- Increased DA and NE release via NMDA receptor stimulation
- Increased dopaminergic activation via DA reuptake inhibition

- Increased adrenergic activation via NE reuptake inhibition

Furthermore, the required dopaminergic stimulation appears to be unrelated to D2/D3 receptor activation and therefore is likely due to the stimulation of D1, or other types of dopamine receptors. This observation was noted during a different study (unpublished) that utilized various dopamine agonists.

Cholinergic stimulation can lead to increases in REM sleep density and duration with a shortened latency and can be achieved using the same methods as mentioned for DA and NE. Cholinergic stimulation can also lead to a state of cerebral activation which is conducive to lucid dreaming. Glutamateric stimulation provides an alternative pathway for cerebral activation and can also result in lucid dream facilitation. When a state of cerebral activation occurs in combination with increases in dopaminergic and adrenergic stimulation, the odds of experiencing a lucid dream are greatly increased. In order to better understand the role of cholinergic and/or glutamateric activation on lucid dreaming, various substances have been considered. This paper focuses on ACh breakdown inhibitors, allosteric potentiating ligands, agonists, and partial antagonists as well as several glutamate receptor agonists and antagonists.

My research has revealed that lucid dreams are facilitated with increases in cerebral activation and that this conducive state can be achieved using the following strategies:

- Increased cholinergic activation via AChE inhibition
- Increased cholinergic activation via nicotinic agonist binding
- Increased cholinergic activation via nicotinic potentiation

- Increased glutamateric activation via NMDA and general glutamate agonist binding coupled with partial glutamateric antagonist blockade.

The summary of my work indicates that vivid dream states can be induced using cholinergic, glutamateric, dopaminergic, and adrenergic stimulation either independently or in various combinations, which in turn leads to an increase in odds of inducing a lucid dream. However, when dopaminergic and adrenergic stimulation occurs simultaneously with cholinergic and/or glutamateric stimulation, there is a significant increase in lucid dream facilitation.

In order to better understand the brain chemistry required to induce lucid dreams, I have utilized various pharmacological substances that can each be characterized by their cholinergic, glutamateric, dopaminergic, and/or adrenergic mechanisms. These substances were used either alone or in specific combinations in order to lend credible evidence to the theoretical basis of this paper.

Other factors can also influence lucid dream induction, such as the concentration of adenosine, as well as the levels of serotonin and melatonin. Melatonin, in particular has been shown to interfere with nicotinic receptor firing [3] and the associated release of dopamine and glutamate. Since melatonin synthesis is often near peak values during the time when galantamine is consumed for lucid dreaming purposes, a direct competition can occur between galantamine induced nicotinic stimulation and melatonin induced nicotinic inhibition. This can interfere with galantamine's effectiveness. A potential solution is to actively inhibit melatonin synthesis during the lucid dream attempt and this case has also been considered in this report. The roles of adenosine and serotonin will be explored in future publications.

Experimental Investigation – Substances used

In order to better understand the roles of Glu, ACh, DA, and NE in facilitating lucid dreams, a detailed test matrix was set up that took advantage of the pharmacological profiles of six different supplements.

1. Galantamine (G)

   Galantamine is an alkaloid that is obtained either synthetically or from the bulbs and flowers of various plant species (Galanthus nivali, Lycoris radiata, Narcissus pseudonarcissus, and other species). It is available without a prescription in the United States. As mentioned above, galantamine is classified as a modest AChE inhibitor, and allosteric modulator of nicotinic receptors, a partial nicotinic agonist, and a modulator of neurotransmitter release. Galantamine has been shown to improve memory and mood in mild to moderate Alzheimer's patients and has increased REM and Stage1 sleep parameters in healthy subjects. The dosage of galantamine used for all tests supporting this paper was 8mg.

2. Huperzine A (Hup)

   Huperzine A is a naturally occurring alkaloid found in the extracts of the firmoss Huperzia serrata species. Huperzine has been used in traditional Chinese medicine for centuries and is available without a prescription in the United States.

   Huperzine A is classified as a fairly potent AChE inhibitor but lacks the specific nicotinic action that galantamine possesses. The dosage of huperzine used for all tests supporting this paper was 200mcg.

3. Nicotine (N)

   Nicotine is available in several forms and often used as a smoking cessation aid. It acts as an agonist for the nicotinic acetylcholine receptors and is available without a prescription in the United States. Nicotine has been shown to cause a release of DA and NE in various parts of the brain via nicotinic stimulation. Nicotine and other nicotinic agonist are being researched as potential treatments for Alzheimer's disease and dementia. One notable problem with such an approach is that nicotinic receptors are subject to desensitization which makes long term treatment options less favorable. The dosage of nicotine used for all tests supporting this paper was 7mg delivered via a transdermal nicotine patch.

4. Bupropion (Bu)

   Bupropion is a prescription drug that is classified as an atypical antidepressant and smoking cessation aid. It acts as a norepinephrine and dopamine reuptake inhibitor, and partial nicotinic antagonist. Its antagonistic properties are primarily limited to the α4β2 and α3β4 receptor subtypes with little to none antagonism of the α7 receptor type [1]. Bupropion is significantly more potent as an inhibitor of dopamine reuptake than of norepinephrine reuptake. The dosage of bupropion used for all tests supporting this paper was 75mg.

5. Amino acid blend (AAB):

   In order to better study the effects of glutamateric activation, a blend of three complimentary amino acids was used: L-aspartic acid, L-glutamine, and L-theanine. This combination was designed to preferentially activate NMDA glutamate receptors. Aspartate (the conjugate base of aspartic acid) is a direct

NMDA agonist. The ability of aspartic acid to cross the blood brain barrier is limited however, to an easily saturated transport mechanism [7] thus the addition of glutamine and theanine. Glutamine easily crosses the blood brain barrier where it can then transform into glutamate (the general agonist for all glutamate receptor types). Theanine also crosses the blood brain barrier and serves a dual purpose: stimulating the release of dopamine and antagonizing specific glutamate receptor subtypes. The fact that theanine is thought to preferentially antagonize the AMPA and Kainate receptor subtypes by an order of magnitude more than the NMDA receptor subtype [5], should allow preferential binding of the available glutamate to the NMDA receptors. The dosages used for all tests incorporating this amino acid blend were 2000mg L-aspartic acid, 4000mg L-glutamine, 300mg L-theanine.

6. Propranolol (Pr)

   Propranolol is a prescription drug characterized as a non-selective adrenergic beta blocking substance. It is typically used for the treatment of hypertension, migraines, and stage fright. Propranolol is classified as a lipophilic drug and can easily penetrate the blood brain barrier. It has also been shown to significantly inhibit the secretion of melatonin from the pineal gland at low doses (10 - 40mg) [4] and can lead to depletion of catecholamines within the brain if large or chronic doses are used [8]. The dosage of propranolol used for all tests supporting this paper was 40mg.

Experimental Investigation – Test Subject

A male, 40 years old, experienced in the techniques of lucid dreaming, was used for this analysis. The subject was well accustomed to using supplements, under controlled conditions, for the purpose of lucid dream induction. The subject has no reported illnesses (mental or physical) or history of illness. The subject does not smoke and abstained from drinking alcohol for a period of at least 6 hours prior to each experiment.

Experimental Investigation – Method

On each experimental night, the subject slept naturally for approximately 3.5 to 4.5 hours before the testing period. The subject was awakened and then ingested the prescribed supplements for that night's test along with approximately 6oz of water. The subject then immediately returned to bed and targeted falling to sleep approximately 45 minutes after the ingestion of the supplements. He reported the results by filling out a detailed questionnaire the following morning which included rankings on dream vividness, recall, lucidity, quality of sleep, and so on. The results were then compiled at the end of the study.

Experimental Investigation – Results

All individual substances and combinations resulted in a significant increase in dream vividness and recall compared to baseline nights. Most, but not all, individual substances and combinations resulted in a significant increase in the likelihood of occurrence of lucid dreams.

Galantamine resulted in lucid dreams when used either alone or in combination with nicotine. When galantamine was combined with propranolol, a significantly higher success rate was reported.

Huperzine failed to produce lucid dreams when used alone, but did result in lucid dreams when combined with either nicotine or bupropion. Surprisingly the huperzine/galantamine combination did not result in any lucid dreams.

Bupropion and propranolol both resulted in a small increase in odds of becoming lucid when used individually.

The amino acid blend resulted in a significant increase in odds of experiencing a lucid dream when used either alone or in combination with galantamine. The combination, although effective, resulted in very short lucid episodes due to the increased likelihood of awakening.

Overall lucidity was achieved on approximately 50% of nights that utilized substances. If the huperzine/galantamine combination is not included, approximately 86% of nights utilizing galantamine resulted in lucidity. A 100% success rate was noted for the amino acid blend as well as the galantamine/propranolol combination. See Table 1 for a complete a summary of results.

Table 1: Summary of Results

Substances used	Dose	Lucidity Rate (# Successes/ Total attempts)	Dream vividness & recall	Lucidity
None (baseline)	-	0% (0/4)	Low	N/A
Galantamine	8mg	75% (3/4)	High	High
Huperzine	200mcg	0% (0/4)	Moderate	N/A
Nicotine	7mg	25% (1/4)	High	Moderate
Bupropion	75mg	33% (1/3)	Moderate	Moderate
Propranolol	40mg	13% (1/8)	High	Moderate
Amino Blend	standard (see description)	100% (4/4)	High	High
Galantamine + Nicotine	8mg + 7mg	66% (2/3)	High	Very high
Galantamine + Propranolol	8mg + 40mg	100% (4/4)	High	Very high
Galantamine + Huperzine	8mg + 200mcg	0% (0/4)	High	N/A
Galantamine + Amino Blend	8mg + standard	100% (3/3)	High	High
Huperzine + Nicotine	200mcg + 7mg	50% (2/4)	High	Moderate
Huperzine + Bupropion	200mcg + 75mg	75% (3/4)	High	High

Table 1: Overall summary of results showing that lucidity was achieved on ~50% of nights using substances, ~71% of nights using galantamine (~86% of nights when huperzine is discounted), and 100% of nights using the amino blend.

Discussion / Conclusion

The results included here strongly support the hypothesis of this paper: Lucid dreams occur as a result of an increase in dopaminergic and adrenergic stimulation coupled with a state of cerebral activation that occurs via either cholinergic stimulation, glutamateric stimulation, or both. Furthermore the effectiveness of the propranolol/galantamine mix is supportive of the idea that melatonin levels can interfere with galantamine by inhibiting nicotinic response. Since propranolol blocks the beta sub-type adrenergic receptors, one might also conclude that the alpha adrenergic sub-type is more involved in lucid dreaming.

The fact that the huperzine/galantamine combination did not produce any lucid dreams is suggestive of a possible critical nicotinic/muscarinic relationship required for lucidity or possibly an interfering interaction between the two substances. The success of the amino blend is strongly suggestive that cholinergic stimulation is not an exclusive pathway to lucidity. There also seems to be a strong parallel relationship between nicotinic activation and NMDA activation; both result in the dopaminergic and adrenergic activation. Also since the galantamine/amino combination resulted in very short lucid episodes (less than 5 minutes), one can conclude that excessive cerebral activation, although effective, is limited due to the interference it causes with sleep in general.

The pharmacological approach to lucid dreaming, although in its early stages of development, has opened the door of this wonderful and philosophical experience to wide range of people who would not have experienced it otherwise. It also promises to create a number of exciting breakthroughs in understanding the limits of human consciousness and may lead to new and better treatments for various psychological disorders and neurological diseases. I hope that these results, although limited in scope and resource, will spawn more intensive curiosity and investigation into this new and exciting field.

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