# The Relationship between Mindfulness and Lucid Dreaming: A Systematic Review

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**Abstract**

The relationship between mindfulness and the frequency with which one experiences lucid dreams is conceptually strong and can be grounded in the continuity hypothesis and in neuroscientific investigations. Only few studies have however been performed regarding this relationship, and comparisons are difficult to make due to methodological issues and discrepancies in results. This study aims to investigate the degree to which this relationship seems to exist and to determine potential factors accounting for the expected discrepancies to guide further research. For that aim, a systematic literature review was conducted in Scopus, Web of Science and PsycInfo. A total of 348 unique studies were screened, of which three studies (consisting of a total of six sub-studies) were included that matched the inclusion criteria. The studies were analysed through a narrative synthesis. The findings reveal an inconclusive association between mindfulness and lucid dreaming frequency. Factors identified as potentially accounting for the inconsistencies among the results were meditation experience, lucid dreaming experience, dream recall, gender, age. This review underlines the importance of pursuing future research that take these factors into account to enhance our understating of the relationship between mindfulness and lucid dreaming.

*Keywords: mindfulness, lucid dreaming, continuity hypothesis, meta-awareness*

# Introduction

Recently there has been a growing interest in incorporating practices that originate from Buddhism in Western society (Sumantry & Stewart, 2021). One such practice is mindfulness, which can be defined as ‘’the awareness that emerges through attention on purpose, in the present moment, and non-judgmentally to the unfolding of experience moment by moment (Kabat-Zinn, 1982; Kabat-Zinn, 2003). Another less well-known phenomenon stemming from Buddhism is lucid dreaming, which is most commonly conceptualized as being aware while one is dreaming (LaBerge et al., 1981). Since both concepts are characterized by being aware of one’s experiences, it is conceivable that an increased level of mindfulness would lead to and increased occurrence of lucid dreams. Both concepts and their potential interrelationships are described in the paragraphs below, as well as a rationale for performing a systematic literature review exploring this relationship.

## Defining lucid dreaming

Lucid dreaming is not an unambiguously defined concept, and even has different definitions in different cultures. That is, while within Buddhism the definition is closely intertwined with their ultimate goal of awakening (Evans-Wents, 1935), in Western society emphasis is put on the measurable aspects of lucid dreaming. The latter will have focus within this investigation due to its relevance for scientific research. The definition that is most often used within research and Western society pertains to the state of being aware of the fact that one is dreaming while dreaming (Aviram & Soffer-Dudek, 2018). This definition originates from the seminal research conducted by LaBerge et al. (1981), which presented the first empirical evidence proving the validity of lucid dreaming. In their study, participants were given instructions to perform specific eye movement patterns during the rapid eye movement (REM) sleep phase, which is associated with intense dreaming. The successful execution of

these pre-determined eye movements by lucid dreamers while in a state of deep sleep provided compelling proof of their awareness while dreaming.

Besides the parsimonious definition of lucid dreaming put forward by LaBerge et al. (1981), there have been attempts to expand it by including elements of dream control. Tart (1988), for instance, proposed that lucid dreams must involve the ability to regulate and intentionally control the dream content. Later it was verified that a minority of children and adults were able to regularly alter their dream content (Voss et al., 2013). Questionnaires aiming to measure the concept of lucid dreaming therefore range from merely questioning whether someone experienced a lucid dream (Schredl & Erlacher, 2004) to questionnaires aiming to also get an image of the degree of control someone has over their dreams (Aviram & Soffer-Dudek, 2018; Voss et al., 2013). Since different studies tend to use different ways of measuring lucid dreaming based on these different definitions (Aviram & Soffer-Dudek, 2018), these differences will be taken into account in analysing the results of the studies to be included in the present review.

**Defining mindfulness**

Mindfulness is a concept that has its origins within Buddhist traditions and was originally called ‘’Sati’’ in Sanskrit. In Western society, it was however not until the development of the mindfulness-based stress reduction training (Kabat-Zinn, 1990) that the concept gained wide-ranging popularity (Van Dam et al., 2018). One of the most commonly used definitions of mindfulness was developed by Kabat-Zinn (1993, 2011) who conceptualized it as: ‘’the awareness that emerges through paying attention on purpose, in the present moment, and non-judgmentally to the unfolding of experience moment by moment’’ However, Kabat-Zinn (2011) himself acknowledged that this definition is one of convenience due to the choice of constructs that are most understandable to Western Audiences (Kabat-

Zinn, 2011). Due to the difficulties of conceptualizing mindfulness, consensus about a unified concept is yet to be reached within Western society (Van Dam et al., 2018; Chiesa, 2013).

One operationalization that is often used within research (Chiesa, 2013), is the one by Bishop et al. (2004). They operationalized mindfulness either as a trait that is based on specific personality characteristics, or as a state that emerges when a person directs their attention purposefully towards experience in the present moment. While trait mindfulness appears to remain stable over time without practice (Brown & Ryan, 2003), it was found that certain mindfulness-based interventions were successful in increasing trait mindfulness (Carmody & Baer, 2008; Shapiro et al., 2008; Shahar et al., 2010). Other definitions that are used as a basis for questionnaires that aim to measure mindfulness include ones based on Buddhist theory, dialectical behavioural therapy, the self-determination theory, and cognitive theory (Van Dam et al., 2018).

Due to the many differences between definitions and operationalizations of mindfulness, it is important to take the conceptual differences and the different ways in which individuals from different background might interpret the items of the questionnaires into account when comparing results of different studies (Grossman & Van Dam, 2011). The importance of this is underlined by the fact that different questionnaires based on different definitions or operationalizations of mindfulness show a lack of correlation (Baer et al., 2006; Thompson and Waltz, 2007). Furthermore, the distinction between trait and state mindfulness is crucial in the analysis of the results as state mindfulness is not necessarily directly proportional to trait mindfulness and vice versa.

**Relationship between mindfulness and lucid dreaming**

Conceptually, both mindfulness and lucid dreaming exhibit notable similarities, thereby making a potential relationship between them conceivable. As stated earlier, lucid

dreaming is thought to require awareness of the fact that one is dreaming while dreaming. This mirrors the meta-awareness of one's mental states during wakefulness (Thompson, 2016; Hunt & Ogilvie, 1988) as observed in mindfulness. This aligns with the finding that the stability of attention and the ability to monitor one's moment-by-moment awareness, cultivated through meditation practices, have been associated with the occurrence and maintenance of lucid dreams (Wallace & Hodel, 2012).

The relationship between mindfulness and lucid dreaming based on meta-awareness is also constituted by neuroscientific findings. Studies have shown a positive correlation between activity in the dorsolateral prefrontal cortex (DLPFC) and both mindfulness and lucid dreaming (Voss et al., 2009; Wheeler et al., 2017), even though it was previously thought that the DLPFC would become non-active while dreaming (Hobson, Pace-Schott & Stickgold, 2000a, p. 42; Hobson, Pace-Schott & Stickgold, 2000b). This provides neuroscientific substantiation for the reliance of mindfulness and lucid dreaming on meta-awareness, as the DLPFC is thought to be associated with secondary consciousness (self-reflective awareness, metacognition) as opposed to primary consciousness (basic perception without reflective awareness) (Hobson, 2009).

Another hypothesis linking mindfulness and lucid dreaming, is the continuity hypothesis, and is thought to consist of two versions. The first version is the incorporation hypothesis (Domhoff, 2017), and revolves around the idea that events occurring in everyday life are continuous with those occurring in dreams. The second version of the hypothesis, however, states that ''dreams accurately reflect emotional concerns but not necessarily actual events'' (Bulkeley, 2012) and is referred to as the cognitive version of the incorporation hypothesis (Hall & Van der Castle, 1966, p. 13-14). Both versions of the hypothesis have been confirmed in various studies (see: Schredl & Homan, 2003; Nielsen et al., 2004 and Bulkeley, 2012).

Based on the incorporation hypothesis, if mindfulness is considered to be an event occurring during wakefulness, it is plausible that practicing mindfulness while being awake could potentially lead to mindfulness occurring as an event while dreaming. This could then result in awareness while dreaming, and therefore in a lucid dream. Alternatively, based upon the cognitive version of the continuity hypothesis, it is possible that maintaining a state of meta-awareness like mindfulness throughout the day may lead to detachment from personal concerns and perceptions, which could extend to the dreaming state and manifest as lucid dreaming.

**Rationale for literature review**

Investigating the relationship between mindfulness and lucid dreaming is interesting for various reasons. In practical sense, if lucid dreaming frequency could be increased by elevated levels of mindfulness throughout the day, this could have numerous benefits associated with lucid dreaming such as enhanced mental health, self-confidence, assertiveness, and psychological resilience in the face of traumatic stress (Doll et al., 2009; Soffer-Dudek et al., 2011). Moreover, lucid dreams can prevent the negative affect induced by nightmares, as the realization that the dream content is not real can alleviate the fear causing the negative affect (Voss & Hobson, 2015; Baird et al., 2019a).

Theoretically, investigating the relationship between mindfulness and the frequency of lucid dreaming could provide evidence supporting (either version of) the continuity hypothesis. Furthermore, it could contribute to our understanding of the relationship between mindfulness and meta-awareness. While there is a strong theoretical connection between the two (Lutz et al., 2015), empirically studying this relationship is challenging due to the difficulties in comparing meta-awareness states across different individuals (Schooler et al., 2011). Lucid dreaming offers a unique opportunity to study this link as it inherently involves meta-awareness, as lucid dreaming per definition requires one to be aware of their mental

state. Investigating the degree to which a relationship between mindfulness and lucid dreaming exists therefore directly contributes to a better understanding of the relationship between mindfulness and meta-awareness as well.

However, despite the theoretical and neurological links between mindfulness and lucid dreaming frequency, few empirical studies have been performed regarding this relationship (Baird et al., 2019b). Moreover, Baird et al. (2019b) note that caution should be exercised when comparing results of these studies due to methodological issues and discrepancies between their results. It would therefore be interesting to investigate the degree to which the relationship between mindfulness and lucid dreaming seems to exist by making thorough comparisons between the different studies, and to determine the factors that could account for the expected discrepancies between the results to guide future research. Therefore, a systematic literature review is conducted aiming to answer the following research question: *"To what extent does mindfulness increase the frequency of lucid dreaming, and what are the potential factors influencing this relationship?"*

## Methodology

In order to address the objectives and answer the research question, a systematic literature review was performed. This type of review is used to appraise and synthesize previous findings to answer specific research questions while limiting bias in the assembly, critical appraisal and synthesis through which the research question is answered (Booth, 2022; Porta, 2014). The present literature review adhered to the guidelines outlined in the PRISMA statement, which state how a systematic literature review should be performed and documented to ensure a replicable search and data extraction process (Page et al., 2021). The SALSA (Search, Appraisal, Synthesis, and Analysis) approach was used for the build-up of the report (Grant & Booth, 2009).

**Search strategy**

PsycInfo, Scopus, and Web of Science were used as search engines. PsycInfo was selected due to its comprehensiveness in the field of psychology, while Scopus was chosen for its broad international coverage, and Web of Science for its emphasis on social sciences. The search string was based on two main concepts, namely ‘’lucid dreaming’’ and ‘’mindfulness.’’ The search string used for each database is provided in Table 1, and was applied to the title, abstract, and keywords in all three databases. The complete search matrix can be found in Appendix A.

**Table 1**

*Search String per Database*

| **Database** | Search string |
|---|---|
| PsycInfo | (‘’lucid dream*’’ OR lucid*) AND (mindful* OR mindful aware*) |
| Scopus | (‘’lucid dream*’’ OR lucid*) AND (mindful* OR mindful aware*) |
| Web of science | TS=(lucid dream* OR lucid*) AND TS=(mindful* OR mindful aware*) |

In this review, the PICO framework was used to establish the eligibility criteria to facilitate the selection of relevant studies. In order to be included in the study, articles were therefore required to address and meet all of the following criteria:

- Patient/problem (P): The participants in the study are considered healthy individuals. In that way, influences of (mental) illness are diminished.

- Intervention (I): Either the mindfulness of the participants was measured or the participants underwent a mindfulness training to serve the aim of getting an image of the current state of the art.
- Comparison (C): Studies with an observational or experimental designs were included to serve the aim of getting an image of the current state of the art.
- Outcome (O): Lucid dreaming frequency, referring to the amount of times a person has a lucid dream in a certain time period.

In addition to the aforementioned criteria, this review included additional selection criteria. Specifically, only peer-reviewed articles published in English or Dutch were eligible for inclusion and articles published before 2013 were excluded.

After the articles were selected that matched the eligibility criteria, data was extracted from these articles. The following information was collected in this process (Higgins et al., 2021):

- Study characteristics
    - Country, recruitment details & aim of (sub-)studies
- Sample characteristics
    - Age, gender, lucid dreaming experience, meditation experience
- Study design characteristics
    - Experimental or observational
    - Type of experimental or observational design
    - Measurement of lucid dreaming frequency
    - If mentioned: lucid dreaming intensity
    - Measurement of mindfulness
        - If experimental: details of intervention (type, duration, follow-up)

- Outcomes
    - Main outcomes
    - Results relevant for (potential) influencing factors

**Quality assessment**

A quality assessment of the included articles was performed to determine the internal quality of these studies, and is performed as a standard procedure within systematic reviews (Billotta et al., 2014; Higgins et al., 2019). To facilitate this assessment, a critical appraisal of all selected articles was performed. All included studies were checked against either the JBI Checklist for Analytical Cross-sectional Studies or the JBI checklist for Randomized Controlled Trials (Martin, 2017a; Martin, 2017b). To facilitate further interpretation, the items of the checklists were connected to a general bias domain: selection bias (representativeness of the sample), performance bias (blinding of participants), detection bias (blinding of researchers), attrition bias (dropout or withdrawal), reporting bias (reporting despite unfavourable outcomes or use of post hoc tests), and confounders (similar participant characteristics across intervention groups) (Booth et al., 2022). For each included study, it was indicated whether a specific type of bias had a high, low, or unclear risk based on established criteria, and was presented in a table (Booth et al., 2022).

**Synthesis method**

A narrative synthesis approach was used to come to conclusions with regards to the existence of a relationship between mindfulness and lucid dreaming frequency and the factors potentially influencing this relationship. This particular approach was selected due to the expected heterogeneity among the included studies, due to the preliminary stage of research in this area (Baird et al., 2019b). The steps for conducting a narrative synthesis, as delineated by Popay et al. (2006), are integrated within the structure of results and discussion.

Within the results section, the (study, sample, and study design) characteristics, outcomes and quality assessment are presented. In this section, a preliminary synthesis regarding the size and direction of the relationship between mindfulness and lucid dreaming is performed based on main outcomes of the included studies. Furthermore, all findings that could potentially account for discrepancies in results between the included studies are gathered and compared. At the end of the results section a quality assessment of the included is depicted to facilitate the assessment of the robustness of the synthesis in the discussion section.

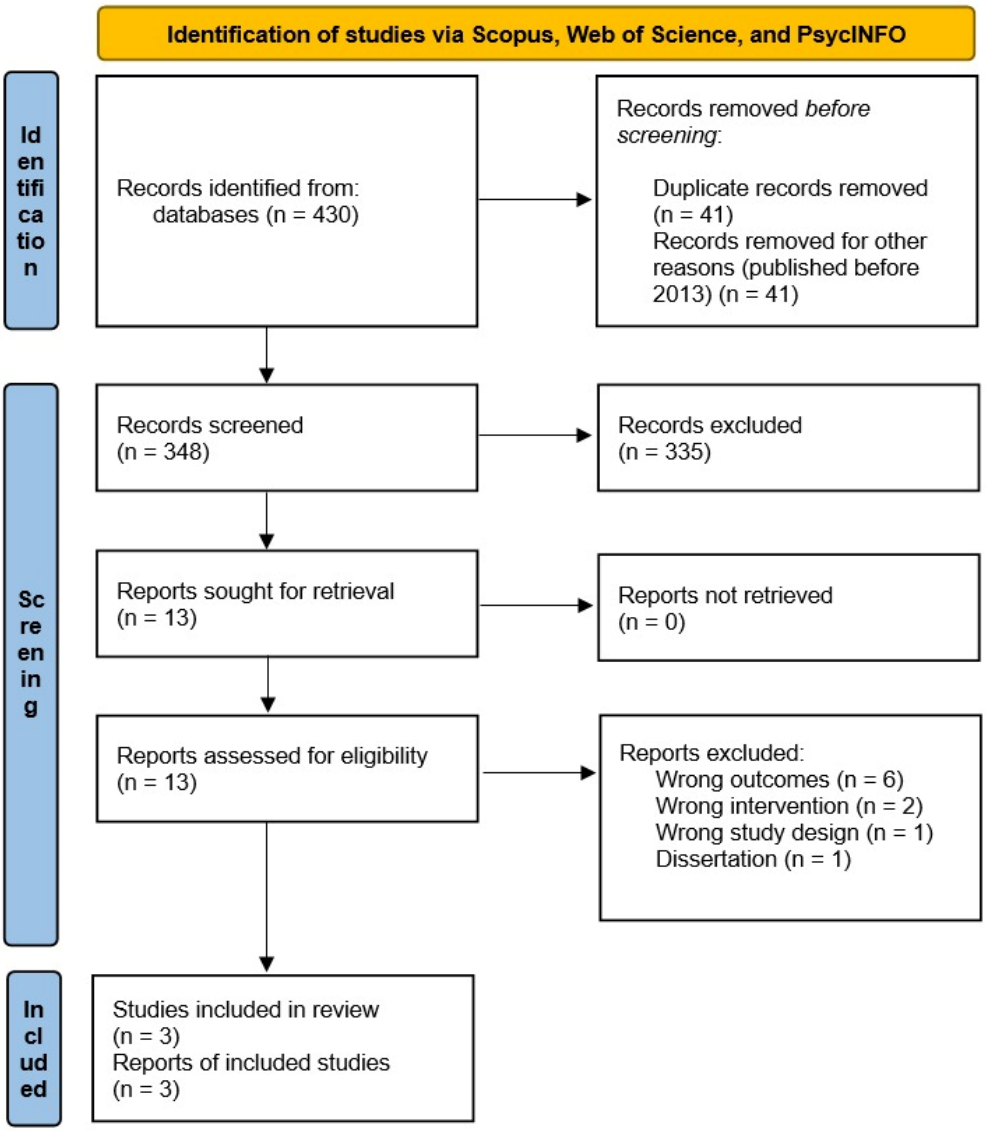
In the discussion section, alternative explanations for the findings and the robustness of the conclusions are discussed. For this, the outcomes of the quality assessment are considered, findings are discussed in light of existing literature and the strengths and limitations of the present systematic literature review are discussed.

## Results

The search yielded 430 results. After removing the duplicates and articles published before 2013, a final total of 348 search results were included in the review. In the end, three articles were included in the review. The full selection process is depicted in figure 1 below.

**Figure 1**

*Prisma Flow Diagram describing the Study Selection Process*




## Study and sample characteristics

This systematic literature review found three separate studies, and a total of six sub-studies (see table 2). The (sub-)studies by Tzioridou et al. (2022), Stumbrys et al. (2015), and one of the three sub-studies by Baird et al. (2019b) directly examined the relationship between mindfulness and lucid dreaming frequency, albeit by use of different dependent or independent variables and samples. The other sub-studies by Baird et al. (2019b) examined

the association between a concept related to mindfulness (meditation experience) and lucid dreaming frequency (Eberth & Sedlmeier, 2012). Notable is that the percentage of experienced lucid dreamers (25.8% – 71.1%) and experienced meditators (0% - 77.5%) differ considerably among the (sub-)studies. While all studies used the same definition to determine whether someone is an experienced lucid dreamer (someone who has one or more lucid dreams per week), definitions for being an experienced meditator differ greatly (from having practiced meditation at some point in their lives to a minimum of five years of meditation experience, with an average of 200 minutes per week and a minimum of 5 weeks experience in meditation retreats).

The mean age of the studies ranged from 25 to 45. One sub-study did not report on age distribution, while another only gave a median age range. That median age range does however fall between the age range of 25 – 45 found in the other studies. Regarding gender distribution, the proportion of women ranged from 45.1% to 64.2%, with only one sub-study consisting of more men than women, while the gender distribution is unknown for one sub-study. None of the studies included measures of lucid dreaming intensity.

**Table 2**

*Study and Sample Characteristics*

| Study | Sub-study | N | % female | Age in years | Lucid dreaming experience | Meditation experience | Recruitment details | Study aim |
|---|---|---|---|---|---|---|---|---|
| Tzioridou et al. (2022) | 1 | 338 | 59.5% | Mean = 25.3 (*SD* = 4.9) | 29.6% one or more LD per month) | N.A. | Secondary analysis of larger dataset from Aarhus University | Examining the relationship between lucid dreaming frequency and dispositional mindfulness for inexperienced lucid dreamers. |
| | 2 | 187 | 64.2% | Median range = 25-39 | 71.1% one or more LD per month) | 77.5% had meditation experience | International lucid dreaming websites, local survey platforms & the University of Marburg platform | Examining the relationship between lucid dreaming frequency and dispositional mindfulness for experienced lucid dreamers. |
| Baird et al. (2019b) | 1 | 178 | 54.4% | Mean = 45 (*SD* = 12) | 25.8% one or more LD per month | 21% had meditation experience | Email lists & advertising in newspapers, and meditation and wellness centres. | Examining the association between meditation experience and lucid dreaming frequency. |
| | 2 | 178 | 54.4% | Mean = 45 (*SD* = 12) | 25.8% one or more LD per month | 21% had meditation experience | Email lists & advertising in newspapers, and meditation and wellness centres. | Examining whether frequent lucid dreamers differ in trait mindfulness subtypes for experienced and inexperienced meditators. |
| | 3 | 140 | Unk. | Unk. | 25.8% one or more LD per month | 0% had meditation experience | Email lists & advertising in newspapers, and meditation and wellness centres. | Examining the influence of (an 8-week) mindfulness training on lucid dreaming frequency |
| Stumbrys et al. (2015) | N.A. | 528 | 45.1% | Mean = 26.4 (*SD* = 10.6) | 49.8% one or more LD per month | 22.3% had meditation experience | German website with the topic of lucid dreaming | Examining the association between dispositional mindfulness and lucid dreaming frequency |

**Study design characteristics**

An overview of the study designs of all different (sub-)studies is presented in Table 4. It shows that all study designs were cross-sectional, except for one sub-study by Baird et al. (2019b) that used an experimental (randomized-blinded controlled trial) design. All (sub-)studies used the same 8-point rating scale for measuring lucid dreaming frequency (Schredl & Erlacher, 2004). Mindfulness was either measured by use of questionnaires in the cross-sectional (sub-)studies, or trained in the sole experimental sub-study. Tziroudou et al. (2022) and Stumbrys et al. (2015) used Freiburg Mindfulness Questionnaire Short-Form (FMI-SF) (Walach et al., 2006). The cross-sectional sub-studies by Baird et al. (2019b), on the other hand, used both the Toronto Mindfulness Scale (TMS) and the Five Facet Mindfulness Questionnaire (FFMQ) (Lau et al., 2006; Baer et al., 2006).

Even though all three questionnaires use a different operationalization of mindfulness with different sub-facets, many sub-facets are comparable to each other. The sub-facets ‘’Observing’’ and ‘’Acting with awareness’’ of the FFMQ, the ‘’Presence’’ sub-facet of the FMI-SF and the ‘’Decentring’’ sub-facet of the TMS all relate to the awareness of one’s own experiences. The sub-facets ‘’Non-reactivity’’ and ‘’Non-judgement’’ of the FFMQ, the ‘’Acceptance’’ sub-facet of the FMI-SF and the ‘’Curiosity’’ sub-facet of the TMS all relate to accepting experience for what they are. The ‘’Describing’’ sub-facet is the only sub-facet that specifically relates to the ability to verbalize one’s experiences. The way the sub-facets are related to each other is displayed in Appendix B.

The experimental (3$^{rd}$) sub-study by Baird et al. (2019b) consists of three conditions: a Mindfulness-Based Stress Reduction (MBSR) program group, a Health Enhancement Program (HEP) group, and a wait-list control group. The MBSR program involved systematic training to develop a sustained, non-aroused state, while the HEP focused on enhancing health and well-being through interventions in four domains: music therapy, nutrition, and physical

activity encompassing walking, stretching, and functional movement. Both programs spanned 8 weeks, with weekly sessions lasting between 2 1/4 to 2 1/2 hours, conducted in a laboratory setting. Both programs involved one all-day session. Participants in the HEP group and MBSR group were respectively required to practice six and seven days a week. In order to check whether lucid dreaming frequency increased for the participants of each group, the 8-point lucid dreaming frequency scale was administered at T1 (baseline), T2 (post-intervention) and T3 (long-term follow-up, approximately 6 months after the program). No manipulation check was performed to check for the effectiveness of the intervention in increasing either state or trait mindfulness.

**Table 3**

*Study Design Characteristics*

| **Study** | **Sub-study** | **Study design** | **Measurement of LD frequency** | **Measurement of mindfulness** |
|---|---|---|---|---|
| Tzioridou et al. (2022) | 1 | Cross-sectional | 8-point rating scale | FMI-SF |
| | 2 | Cross-sectional | 8-point rating scale | FMI-SF |
| Baird et al. (2019b) | 1 | Cross-sectional | 8-point rating scale | TMS & FMQ |
| | 2 | Cross-sectional | 8-point rating scale | TMS & FMQ |
| | 3 | Experimental (RCT) | 8-point rating scale | Measurement intervals: T1 (baseline), T2 (post-intervention) and T3 (~6 months post-intervention. Conditions: MBSR-training, HEP-training and wait-list control |
| Stumbrys et al. (2015 | N.A. | Cross-sectional | 8-point rating scale | FMI-SF |

## Outcomes

An overview of the results is presented in Table 4. A distinction is made between those results directly related to the association or relationship between mindfulness and lucid dreaming frequency, and those relevant for identifying potential influencing factors explaining the expected inconsistencies in the results.

### *Outcomes regarding relationship mindfulness and lucid dreaming frequency*

From Table 6 it shows that four out of six sub-studies with results relevant for the association or relationship between mindfulness and lucid dreaming frequency found significant results. Nonetheless, two of these studies examines the association between a concept related to mindfulness (meditation experience) and lucid dreaming frequency, thereby investigating this association indirectly. Of the sub-studies that did not find a significant relationship or association, one had an experimental design and one an observational design.

### *Outcomes regarding potential influencing factors*

From the studies, multiple outcomes could be identified that were relevant for identifying factors that potentially influence the relationship or association between mindfulness and lucid dreaming frequency.

Meditation experience was found to be significantly associated with lucid dreaming frequency in the sole sub-study examining this association (Baird et al., 2019b), and was a significant moderator in the sole sub-study in which it was included as such (Stumbrys et al., 2015). This was constituted by another sub-study revealing that experienced meditators scored higher on the sub-scales of the TMS and FFMQ than inexperienced meditators, and that different sub-facets of mindfulness are associated with being an experienced lucid dreamer for experienced and inexperienced meditators (Baird et al., 2019b). However, in two

studies factors explicating the duration and frequency of participants' meditation practice were found to be insignificantly associated with lucid dreaming frequency.

Additionally, the data show a pattern in which the association between mindfulness and lucid dreaming frequency is only significant in sub-studies with a high proportion of experienced lucid dreamers. The sub-studies revealing a significant association consisted of 77.1% and 49.8% experienced lucid dreamers (Tzioridou et al., 2022; Stumbrys et al., 2015), in contrast to the sole cross-sectional study that did not find a significant association and consisted of 29.8% of experienced lucid dreamers (Tzioridou et al., 2022).

Furthermore, both gender, age and/or dream recall may serve as (an) influencing factor(s) in the relationship between mindfulness and lucid dreaming frequency. In one sub-study, either age, gender and/or dream recall were significant control variables, leading to no specific mindfulness sub-facet being significant after controlling for them (Tzioridou et al., 2022). In another study age appeared to be a significant control variable, leading to only one specific sub-facet being significant after controlling for age (Stumbrys et al., 2015). In other sub-studies these control variables were not included or insignificant.

**Table 4**

*Main Outcomes regarding Association/Relationship between Mindfulness and Lucid Dreaming and Outcomes relevant for Identifying Potential Influencing Factors.*

| Study | Sub-study | Main outcomes | Influencing factors |
|---|---|---|---|
| Tzioridou et al. (2022) | 1 | Association between trait mindfulness and lucid dreaming frequency was non-significant. | Insignificant association in a sample predominantly consisting of inexperienced lucid dreamers. |
| | 2 | Association between trait mindfulness and lucid dreaming frequency was significant. | Significant association in a sample predominantly consisting of experienced lucid dreamers. Either age, gender and/or dream recall were significant control variables. Both ‘’presence’’ and ‘’acceptance’’ sub-facet insignificant after controlling for age, gender and dream recall. |
| Baird et al. (2019b) | 1 | Significant association between meditation experience and lucid dreaming frequency. | Significant association between meditation experience and lucid dreaming frequency. Insignificance of meditation in years, hours of meditation practice per week, total hours of meditation practice, and total number of retreat hours. |
| | 2 | Significantly higher levels of mindfulness for frequent lucid dreamers. | Experienced meditators had significantly higher associations with all mindfulness sub-scales. Different sub-facets of the mindfulness questionnaires were significantly associated with lucid dreaming frequency for experienced (observing, acting with awareness and decentring) and inexperienced meditators (describing). |
| | 3 | No significant increase in lucid dreaming frequency found at all intervals and for all conditions. | N.A. |
| Stumbrys et al. (2015) | N.A. | Significant association between trait mindfulness and lucid dreaming frequency. | Significant association in a sample with relatively high amount of experienced lucid dreamers. Meditation experience was significantly associated with lucid dreaming frequency, and served as a significant moderator. Meditation expertise (in years) and meditation practice (per week) were insignificantly associated with lucid dreaming frequency. Only ‘’presence’’ sub-facet significant after controlling for age. |

**Quality assessment**

A summary of the quality assessment of all (sub-)studies is depicted in Table 5. The score per item for the experimental sub-study is shown in Appendix C and for the observational studies in Appendix D. Table 7 shows that all sub-studies either show a high risk of bias (n = 4) or a moderate risk of bias (n = 2). Information bias was present in all (sub-)studies (n = 6), while selection bias was present in four (sub-)studies. Apart from that, the sole experimental study showed a high risk of bias regarding allocation concealment, blinding of participants and personnel and a high risk of attrition bias.

Many forms of bias were introduced as a result of missing reporting, such as selection bias, and all forms of bias for the experimental study. Furthermore, information bias was deemed present in all sub-studies due to the use of self-report for measuring mindfulness and lucid dreaming frequency. For lucid dreaming frequency, the main risk is that the use of a self-report scale can introduce errors related to remembering past experiences. Despite the high retest validity of the 8-point scale used in all included studies in this review (Stumbrys et al., 2013), these errors can still lead to inter-individual variations in individuals' responses. Use of self-report for mindfulness for example includes risks like potential different interpretations of items by experienced and inexperienced meditators, and limited introspection abilities of participants (see Grosmann, 2011; Bergomi et al., 2012 and Van Dam et al., 2018 for further discussion).

**Table 5**

*Summary Quality Assessment Cross-sectional studies and RCT*

| Study | Sub-study | Score | Risk of bias | Types of potential biases |
|---|---|---|---|---|
| Tzioridou et al. (2022) | 1 | 37,5% | High | Selection & information bias |
| | 2 | 37,5% | High | Selection & information bias |
| Baird et al. (2019b) | 1 | 62,5% | Moderate | Information bias |
| | 2 | 46,2% | High | Selection bias, allocation concealment, blinding of participants and personnel, attrition bias |
| | 3 | 37,5% | High | Information bias |
| Stumbrys et al. (2015) | N.A. | 50% | Moderate | Selection bias & information bias |

## Discussion

The aim of this review was to investigate the degree to which mindfulness increases the frequency of lucid dreaming, and to determine the factors that could account for expected discrepancies between outcomes regarding this relationship. In that way, future research can be informed about what to focus on when further establishing this relationship.

### Mindfulness and lucid dreaming frequency

Based on the current systematic literature review, the evidence base regarding the association or relationship between mindfulness and lucid dreaming frequency was found to be inconclusive. four out of five sub-studies with relevant results for this relationship found significant associations. The other sub-studies found insignificant associations, but none were found to be negative. These mixed significant and significant findings indeed point towards there being factors at play that might account for the discrepancies between the results, as was expected based on previous research (Baird et al., 2019b). The finding that the risk of bias of these five sub-studies were found to be either high (n = 4) or moderate (n = 2) substantiates this even further.

Nonetheless, the sole sub-study with an experimental design did not find a significant relationship, which points towards the conclusion that a causal relationship between mindfulness and lucid dreaming frequency does not exist. It should however be noted that the 8-week training might have been too short to increase the trait mindfulness of the participants, as no manipulation check was performed in this sub-study. Furthermore, both open-monitoring and focussed-attention techniques were used, while meta-awareness is thought to underly the potential relationship between mindfulness and lucid dreaming frequency (Voss et al., 2009; Wheeler et al., 2017). Due to their different nature, open-monitoring is thought to cultivate meta-awareness more explicitly and to a larger degree, while it has been suggested that an excess of meta-awareness may be counterproductive in focussed-attention practice (Lutz et al., 2015). Furthermore, this study showed a high overall risk of bias. The biases for this study could have skewed the estimated effects, potentially leading to either an overestimation or underestimation of the actual effect.

**Potential influencing factors**

Based on the results, meditation experience, lucid dreaming experience, gender, age, and/or dream recall were found to be factors potentially explaining the discrepancies between the results in the included studies in this review.

Meditation experience was the first factor that could be identified as potentially influencing the relationship between mindfulness and lucid dreaming due to its significance in all studies in which it was included. The relationship between meditation experience and increased levels of mindfulness is conceivable as meditation experience is related to increased levels of mindfulness as Buddhist traditions have held the conception that mindfulness can be cultivated through long-term meditation practice for centuries (Baer et al., 2008). This conception has been confirmed by a meta-analysis consisting of 39 experimental studies (Eberth & Sedlmeier, 2012). Nonetheless, it should be noted that two studies found that all

variables explicating the length and frequency of meditation practice were insignificantly associated with lucid dreaming frequency, therefore deeming it possible that certain personality characteristics that lead people to engage in mindfulness practice are explanatory for the association between meditation experience and lucid dreaming frequency. This idea is strengthened by the finding that the sole experimental study found that mindfulness did not lead to increased lucid dreaming frequency, even though the aforementioned different explanation for the results of this study should be taken into account.

Lucid dreaming experience was a second factor that could be identified. The association between mindfulness and lucid dreaming frequency was found to be significant only in samples consisting of relatively high percentages of lucid dreamers (77.1% and 49.8%) and not in a sample consisting of 29.8% lucid dreamers. An interpretation of this results could be that individuals who naturally experience lucid dreams have a heightened sensitivity to the effects of mindfulness. This relationship seems to not yet have been investigated in literature.

Furthermore, age, gender and/dream recall were found to be potentially relevant influencing factors. Age is a known factor to influence lucid dreaming incidence (Voss et al., 2012), however no studies were found that investigated the influence of age on lucid dreaming on adult samples like the studies in the current review. With regards to dream recall it is fairly easy to recognize that someone who has a higher ability to recall their dreams, would also be capable of memorizing more of their lucid dreams and therefore report a higher amount of lucid dreams on the rating scale. Nonetheless, another explanation could be that both dream recall frequency and lucid dreaming frequency are related to similar personality characteristics. The latter is constituted by a study that found that both are related to the trait ‘’openness to experience’’ (Schredl et al., 2022). No relevant existing literature was found about the potential link between gender and lucid dreaming frequency.

It should however be stressed that all of the above stated factors should be considered *potential* influencing factors that need further investigation. This aspect becomes even more important when one acknowledges the limited representativeness of the samples. Both the study by Tzioridou et al (2022) and Stumbrys et al. (2015) were only representative for a relatively young age group, with respective average means of 25 and 26 years old. Moreover, recruitment for the latter study took place through a website related to the topic of lucid dreaming, therefore introducing interest in lucid dreaming as a potential confounder. The potential influencing factors identified in this study might therefore only be valid in specific study samples.

Furthermore, the significance of certain control variables and moderators might have been influenced by the finding that the risk of bias for the six sub-studies on which these potential influencing factors are based was either high (n = 3) or moderate (n = 2). The risk of information bias that was deemed present in all of these sub-studies could have led to either an overestimation or underestimation of the relationship under investigation (Althubaiti, 2016), which could have influenced the significance of these potential influencing factors. Besides, four out of five sub-studies on which the identification of these factors was based showed a high risk of selection bias, thereby introducing uncertainty whether unknown variables might have caused the significance of these potential influencing factors.

**Strengths and limitations of the present review**

The current review contributes to the current evidence base regarding the relationship between mindfulness and lucid dreaming frequency, especially because of the insights it provides regarding potential factors causing the found inconsistent results. The review used strict inclusion and exclusion criteria, allowing for thorough examination of the few included studies, especially considering the time limitations of this research. Furthermore, the systematic approach paves the way for future studies to replicate and build upon the findings

by adjusting the inclusion and exclusion criteria. This approach also minimizes potential biases and subjectivity, thereby enhancing the reliability of the conclusions (Booth et al., 2022).

However, it is important to acknowledge the limitations of this review as well. The review was not pre-registered as advised in the PRISMA-guidelines, thereby introducing detracting the credibility of the results and conclusions of this review. Furthermore, in some respects the selection criteria were stringent. Articles published before 2013, and unpublished papers and dissertations were excluded. Moreover, the review exclusively focused on studies using lucid dreaming frequency as an outcome variable, thereby potentially overlooking other studies that could reveal relevant influencing factors.

On the other hand, the lenience of the selection criteria also posed limitations to the review. Firstly, the review did not focus on studies that used the same questionnaires for measuring mindfulness. This is noteworthy because comparability between different mindfulness questionnaires is a known challenge in this research field (Bergomi et al., 2012). Furthermore, the review included studies both assessing trait and state mindfulness. While these concepts seem related to each other (e.g. Shahar et al., 2008), they are still thought to be separate concepts (Bishop et al., 2004), thereby complicating the synthesis of results from studies that used these different concepts. The lenience of the selection criteria with regard to these aspects may have introduced a risk of validity for the conclusions in this review.

**Recommendations**

Based on the found results, the quality assessment and the limitations of this review, several recommendations can be made. Firstly, it is recommended to conduct more observational investigations to learn about the ways in which the influencing factors identified in this review impact the potential association between (the specific sub-facets of)

mindfulness and lucid dreaming frequency. To achieve this, it is crucial to distinguish between frequent and infrequent lucid dreamers, as well as between experienced and inexperienced meditators, as demonstrated in Baird et al. (2019b). This distinction is important because both being a frequent lucid dreamer and being an experienced meditator were identified as potential influencing factors in this review. By taking age, gender and dream recall into account in the analysis, it is possible to determine the effects of these variables for these sub-groups specifically.

Furthermore, it is recommended to conduct more experimental research to establish a causal link between mindfulness and lucid dreaming frequency. Longer and more intensive mindfulness training using different meditation techniques might reveal a significant relationship, as opposed to the experimental study included in this review. Specifically, it could be beneficial to collaborate with various mindfulness centres offering long and intensive training using different meditation styles. Integrating a manipulation check to assess the effectiveness of the training in increasing trait or state mindfulness through use of questionnaires is advised. This step would help rule out alternative explanations, such as personality differences or individual interests. For trait mindfulness, the manipulation check could be expanded by testing whether functional or structural brain changes in, for example, the DLPFC have taken place through use of (f)MRI as this brain area is thought to be related to both lucid dreaming and mindfulness (Voss et al., 2009; Wheeler et al., 2017).

Moreover, as the results in this review raised questions about whether specific personality traits associated with both higher mindfulness and lucid dreaming frequency could account for the findings, it is suggested to conduct an experimental study specifically designed to confirm or disprove this hypothesis. Specifically, an experimental study consisting of a group of frequent and a group of frequent lucid dreamers could test whether a specific group shows higher pre-post change scores with regard to mindfulness.

Additionally, for all future studies, it is worth considering a more elaborate measurement method for lucid dreaming frequency than merely the use of the 8-point rating scale by (Schredl & Erlacher, 2004). Firstly, having participants report every morning for a month whether they experienced a lucid dream, could reduce errors linked to retrospective recall and mitigate the potential influence of dream recall. Alternatively, equipping participants with an EEG home device to provide more objective confirmation of their lucid dreaming experiences could be considered. Furthermore, use of the FILD-questionnaire could be considered to be able to investigate whether different associations or relationships would be found when the length and intensity of a lucid dream are taken into account (Aviram & Soffer-Dudek, 2018).

Furthermore, it is recommended to use different types of mindfulness questionnaires as long as there is no consensus in the research field about what mindfulness questionnaire should be used. This would allow future systematic reviews or potential meta-analyses to make more valid comparisons between the results obtained in different studies.

Lastly, all studies should carefully consider the representativeness of their sample. It is, in specific, advisable not to recruit participants exclusively through platforms on the topic of lucid dreaming to prevent potential bias from interest in the subject. Moreover, to enhance the possibility of generalizing the results, targeting a well-defined age subgroup or striving for a sample that accurately represents the entire adult population is important.

## Conclusion

In conclusion, this review reveals that the evidence base regarding the association or relationship between mindfulness and lucid dreaming frequency is inconclusive. Factors that were identified that could potentially account for these inconclusive results are: meditation experience, lucid dreaming experience, dream recall, age and gender. Furthermore, the risk of

bias of the six included sub-studies was found to be high (n = 4) or moderate (n = 2). Based on these findings, comprehensive recommendations were made to give directions to future research.

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# Appendix A

**Table 5**

*Search matrix*

| Date | Source | Search string (databases) or search method (other sources) | Total hits | Remarks |
|---|---|---|---|---|
| **16-06** | Scopus | (TITLE-ABS-KEY(lucid* OR (lucid AND dream*)) AND TITLE-ABS-KEY( mindful* OR (mindful AND aware*))) | 0 | Broadening of keywords required |
| **16-06** | Scopus | (TITLE-ABS-KEY(lucid* OR (lucid AND dream*)) AND TITLE-ABS-KEY (mindful* OR (mindful AND aware*) OR meditat*)) | 30 | Relevant, but not a lot of results |
| **16-06** | Scopus | ALL(("lucid*") OR ("lucid AND dream*)) AND ALL (("mindful*") OR ("mindful AND aware*") OR (meditat*)) | 473 | Final search |
| **16-06** | Web of Science | TS=(lucid dream* OR lucid*) AND TS=(mindful* OR mindful aware* OR meditat*) | 49 | Final search |
| **16-06** | PsycInfo | ALL(‘’lucid dream*’’ OR ‘’lucid*’’) AND ALL (‘’mindful*’’ OR mindful aware*’’ OR meditat*’’) | 88 | Final search |

## Appendix B

**Table 6**

*Comparison of sub-facets of the FFMQ, FMI-SF and TMS*

| **Overarching theme** | **FFMQ** | **FMI-SF** | **TMS** |
|---|---|---|---|
| Awareness of one's experiences | Observing & acting with awareness | Presence | Decentring |
| Accepting experiences for what they are | Non-reactivity & non-judgement | Acceptance | Curiosity |
| Verbalizing one's experiences | - | - | Describing |

# Appendix C

**Table 7**

*Quality Assessment Randomized Controlled Trial*

| Study | Sub-study | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Score | Risk of bias |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Baird et al. (2019b) | 3 | U | U | U | U | U | U | Y | U | Y | Y | Y | Y | Y | 46.2% | High |

*Note.* Abbreviations: Y, Yes; N, No; N/A, Not Applicable; U, Unclear

JBI Checklist items:

1. Was true randomization used for assignment of participants to treatment groups?
2. Was allocation to treatment groups concealed?
3. Were treatment groups similar at baseline?
4. Were participants blind to treatment assignment?
5. Were those delivering treatment blind to treatment assignment?
6. Were outcome assessors blind to treatment assignment?

7. Were treatment groups treated identically other than the intervention of interest?
8. Was follow-up complete and if not, were differences between groups in term of their follow-up adequately described and analysed?
9. Were participants analysed in the groups to which they were randomized?
10. Were outcomes measured in the same way for treatment groups?
11. Were outcomes measured in a reliable way?
12. Was appropriate statistical analysis used?
13. Was the trial design appropriate, and any deviations from the standard RCT design (individual randomization, parallel groups) accounted for in the conduct and analysis of the trial?

## Appendix D

**Table 8**

*Quality Assessment Cross-sectional Studies*

| Study | Sub-study | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Score | Risk of bias |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Tzioridou et al. (2022) | 1 | N | N | N | N | Y | Y | N | Y | 37,5% | High |
| | 2 | N | N | N | N | Y | Y | N | Y | 37,5% | High |
| Baird et al. (2019b) | 1 | Y | Y | N | N | Y | Y | N | Y | 62,5% | Moderate |
| | 3 | Y | Y | N | N | Y | N | N | U | 37,5% | High |
| Stumbrys et al. (2015) | - | N | Y | N | N | Y | Y | N | Y | 50% | Moderate |

*Note.* Abbreviations: Y, Yes; N, No; N/A, Not Applicable; U, Unclear

JBI Checklist items:

1. Were the criteria for inclusion in the sample clearly defined?
2. Were the study subjects and the setting described in detail?
3. Was the exposure measured an a valid an reliable way?
4. Were objective, standard criteria used for measurement of the condition?
5. Were confounding factors identified?
6. Were strategies to deal with confounding factors stated?
7. Were the outcomes measured in a valid and reliable way?
8. Was appropriate statistical analysis used?