Psilocybin Microdosing for Anxiety Relief in Young Adults: A Comparative Review of Emerging Evidence

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Additional material is published online only. To view please visit the journal online.

Cite this as: Shabir K. Psilocybin Microdosing for Anxiety Relief in Young Adults: A Comparative Review of Emerging Evidence. Premier Journal of Science 2024;1:100036

DOI: https://doi.org/10.70389/PJS.100036

Received: 4 November 2024
Revised: 11 November 2024
Accepted: 16 November 2024
Published: 3 December 2024

Ethical approval: N/a
Consent: N/a
Funding: No industry funding
Conflicts of interest: N/a
Author contribution: Kanwal Shabir – Conceptualization, Writing – original draft, review and editing
Guarantor: Kanwal Shabir
Provenance and peer-review: Commissioned and externally peer-reviewed
Data availability statement: N/a

ABSTRACT

BACKGROUND

Anxiety disorders are increasingly prevalent among young adults. Traditional treatment options often fall short, and many patients live with treatment-resistant anxiety. Psilocybin is a psychedelic compound that has gained attention for its therapeutic potential against anxiety when used in microdoses.

OBJECTIVE

This review aims to evaluate the emerging evidence on psilocybin microdosing as a potential intervention for anxiety relief in young adults. It examines psilocybin microdosing efficacy, safety, and underlying mechanism of action.

METHODS

A systematic search was conducted across three major databases: PubMed, PsycINFO, and CINAH. Keywords were selected related to psilocybin microdosing and anxiety in young adults. Inclusion criteria focused on peer-reviewed studies published in English from 2014 to 2024, encompassing human participants aged 18–35 years. Data were synthesised narratively with thematic analysis of anxiety-related outcomes across studies. Tabular comparisons to highlight psilocybin microdosing's relative efficacy, limitations, and methodological variations were used.

FINDINGS

The findings suggest that psilocybin microdosing is associated with improved mood and reduced anxiety symptoms. It also enhances emotional resilience and mental well-being. Microdosing can modulate serotonin receptors, promote neural plasticity, and improve connectivity in certain brain regions implicated in emotional regulation. Short-term benefits include increased focus and cognitive flexibility, while long-term effects may involve sustained reductions in anxiety and improved overall mental well-being.

CONCLUSION

Psilocybin microdosing presents a promising alternative for managing anxiety in young adults for those who are resistant to traditional therapies. However, the variability in study designs and dosing regimens highlights the need for further research to establish standardised protocols and assess long-term safety and efficacy.

Keywords: Psilocybin microdosing, Anxiety relief, Young adults, Serotonin modulation, Neuroplasticity

Introduction

The modern lifestyle is characterised by constant connectivity, financial stress, and work-life imbalance. These factors place significant pressure on individuals physical and mental health.[1–3] In this fast-paced lifestyle, young adults are more prone to developing anxiety disorders.[3] Young adults aged 16–24 years are considered most vulnerable to anxiety and have been reported to have poor mental health.[4] Approximately 1 in 6 adults in England experience anxiety or depression symptoms, with global estimates reaching 58 million.[5,6] The COVID-19 pandemic further increased the prevalence of anxiety disorder to 21% in early 2021.[5–8]

The recent data suggest that around 20% of children aged 8–16 were identified to have mental disorders in 2023.[7] This trend continuously increases, with a 12% rise every year.[5,6] The severity level of anxiety varies from person to person and can impact their ability to perform daily tasks. In some cases, it may cause disability and life threats.[7] Psychotherapy and pharmacological interventions are the commonly available treatments.[6–9] However, around 20–60% of patients with psychiatric illnesses are unresponsive to standard therapies.[9] The prevalence of treatment-resistant anxiety disorders is rising, necessitating efficient therapeutic strategies.[10]

Novel treatment approaches are considered alternative therapies for those who do not respond to conventional treatments.[11] Psilocybin is a naturally occurring psychedelic compound found in Psilocybin mushrooms. It has a long history of being used in indigenous rituals.[12] It is a psychedelic substance that alters perception, mood, and cognitive processes. It can profoundly impact sensory and psychological processes.[13] Recent studies[14] on cancer-related anxiety showed that controlled doses of psilocybin can cause significant and sustained reductions in anxiety and depression.[14–16]

Microdosing refers to the practice of consuming a subperceptual or subtherapeutic dose of a psychedelic substance. Typically, around 5–10% of a standard recreational dose is used in microdosing.[14] This dosage is low enough to avoid the hallucinogenic effects associated with full-dose psychedelic experiences. It enables users to function normally without significant disruptions to perception or cognition.[17] Full-dose experiences can profoundly alter consciousness and need a controlled environment. In contrast, microdosing is often part of daily routines.[15–17] Microdosing aims to achieve small cumulative effects over time.[16,17] This distinction makes microdosing a more accessible option for individuals seeking potential mental health benefits without the intense or overwhelming experiences associated with higher doses.

The possible therapeutic effects of psilocybin microdosing for anxiety disorders have drawn much attention. However, existing research on psilocybin microdosing is still limited. Much of the clinical

evidence centred on macrodosing in supervised settings. The therapeutic efficacy, safety, and long-term effects of microdosing remain underexplored. Therefore, the purpose of this review is to examine the emerging evidence on psilocybin microdosing as a potential treatment for anxiety relief in young adults. This review compares the recent findings to explore its efficacy and safety. It also explores the mechanisms of psilocybin microdosing to assess its role as a viable option for anxiety management in young adults.

Methods

Search Strategy

This review applied a structured and systematic search strategy across three major databases: PubMed, PsycINFO, and CINAHL. Search terms were selected to gather relevant literature on psilocybin microdosing and its potential for anxiety relief, especially in young adults. Keywords included combinations of 'psilocybin,' 'microdosing,' 'anxiety,' 'young adults,' 'psychedelics,' and 'mental health.' Boolean operators were also used to optimise search results. The combinations such as 'psilocybin AND anxiety' and 'microdosing AND young adults' were used. Filters were applied to limit results to peer-reviewed articles published in English within the past 10 years (2014–2024). Additionally, reference lists of relevant studies were reviewed to identify any further studies meeting these criteria. For thematic analysis, studies were selected based on predefined inclusion criteria, and key themes were identified through a detailed synthesis of study outcomes.

Inclusion and Exclusion Criteria

This review included studies that met the following criteria: (1) peer-reviewed articles published in English within the past 10 years (2014–2024); (2) focused on the effects of psilocybin microdosing focusing on anxiety; (3) involved human participants within the young adult age range (typically 18–35 years); and (4) provided quantitative or qualitative data on anxiety outcomes associated with psilocybin microdosing. Studies were excluded if they (1) did not focus on psilocybin microdosing (studies on full-dose psychedelics); (2) targeted age groups outside the young adult demographic; (3) were non-peer-reviewed publications, case reports, editorials, or commentaries; or (4) lacked clear anxiety-related outcome measures.

Data Extraction and Synthesis

A systematic approach to data extraction was applied to acquire relevant details from each study. Details, including sample size, demographic characteristics (age and gender), dosage and duration of psilocybin microdosing, assessment tools for anxiety, and reported outcomes, were carefully noted. Key data points were categorised under various themes using Braun and Clarke's thematic analysis framework for structured analysis and comparison. Narrative and tabular summaries were generated to compare anxiety-related outcomes across treatments for data synthesis (Table 1). Psilocybin microdosing's relative efficacy and limitations were also recorded. Discrepancies in study designs or outcome measures were noted, and findings were contextualised based on the strength and quality of evidence across studies.

Understanding Psilocybin Microdosing

Historical and Modern Perspectives on Psychedelic Research

Psychedelic research has ancient roots in early human societies and has been used in religious and healing rituals.[15–18] Many ancient civilisations, like the Olmec, Maya, and Aztecs, incorporated psilocybin-containing mushrooms into their spiritual practices.[15] The shamans claim these practices provide insights into illness and facilitate healing.[14–16] Research into psychedelics gained attention after the isolation of mescaline in 1897 and the synthesis of LSD in 1943.[17] In the 20th century, Albert Hoffman discovered the LSD's psychoactive effects, which provided a new direction to psychedelic research. However, political and cultural backlash in the 1960s halted psychedelic research for about 25 years.[18] A revival in psychedelic research was seen in the 1990s, which reintroduced psychedelics. Recent research has especially highlighted psilocybin's potential for anxiety relief and mood disorders.[15–18]

Chemical and Pharmacological Profile of Psilocybin

Chemical Profile of Psilocybin

Psilocybin is a naturally occurring psychoactive compound in over 100 mushroom species, including the Psilocybin genus.[4] It is a tryptamine-based compound and serves as a prodrug which converts to psilocin upon ingestion; refer to Figure 1. Psilocin acts on the central nervous system to produce the psychoactive effects associated with 'magic mushrooms' by binding primarily to serotonin 5-HT_{2A} receptors.[8–12]

Mechanism of Action

The therapeutic and psychoactive effects of Psilocybin are linked to its psilocin metabolite. Its metabolite interacts primarily with the 5-hydroxytryptamine 5-HT_{2A} receptor, a serotonin receptor in the brain associated with mood and cognition. Psilocin acts by binding and activating these receptors; see Figure 2. It particularly acts within the prefrontal cortex, which involves mood regulation and decision-making. Activation of the 5-HT_{2A} receptors in this area can reduce overactivity linked to anxiety and depression.[13]

Psilocybin also affects the amygdala in the brain, which is involved in emotional processing. This modulation may alleviate excessive emotional responses and offer relief from anxiety and mood disorders.[13,14] Furthermore, psilocybin enhances connectivity between the cortex and thalamus and supports sensory integration, unlike traditional anxiolytics. Psilocybin also promotes neural plasticity and improves long-term mental health by enabling adaptive changes in neural circuits. This enhanced neuroplasticity may contribute

DOI: https://doi.org/10.70389/PJS.100036 | Premier Journal of Science 2024;1:100036

Table 1 | Summary of Studies on Psilocybin Microdosing and Its Effects

Study	Authors	Participants	Study Design	Duration	Microdosing Methodologies (Dosage and Frequency)	Subjective and Objective Measurements	Key Findings	Implications	Limitations
1.	Rootman et al.[21]	4,050 microdosers, 4,653 non-microdosers	Cross-sectional survey	N/A	Varied dosing routines, sometimes combined with Lion's Mane, chocolate, or niacin.	Subjective: Self-reported mental health status (anxiety, depression, stress)	Lower levels of anxiety, depression, and stress among microdosers compared to non-microdosers.	Highlights the need for further longitudinal research on mental health impacts.	Self-selected sample, reliance on self-reported data.
2.	Hartong & van Emmerik[22]	186 current microdosers, 77 former microdosers, 234 controls (microdosing-naïve)	Cross-sectional study	N/A	Not specified in detail, assumed regular microdoses based on user type (current vs former)	Subjective: State-Trait Anxiety Inventory, Five-Facet Mindfulness Questionnaire	Subjective: State-Trait Anxiety Inventory—Trait subscale (STAI-T); Five-Facet Mindfulness Questionnaire (FFMQ-15)	Suggests the need for RCTs to clarify the role of mindfulness in anxiety reduction.	Potential confounding: No significant results were found when excluding macrodose experiences.
3.	Rootman et al.[23]	953 microdosers, 180 controls	Naturalistic, observational study	30 days	Self-administered small doses; frequency not specified	Subjective: Mood and mental health assessments; Objective: Psychomotor performance assessments in older adults	Small to medium improvements in mood and mental health; older adults showed enhanced psychomotor performance.	Provides evidence for mood improvement, particularly in older adults.	Short follow-up duration, lack of randomisation.
4.	Kuypers[24]	Review (14 studies)	Systematic review	N/A	LSD (10–20 micrograms) or psilocybin (‹1–3 milligrams) administered as repeated low doses	Subjective: Mood and cognitive assessments (time perception, thinking processes); Objective: Physiological measures (e.g., heart rate)	Subtle positive effects on cognitive processes related to mood; therapeutic value remains uncertain.	Potential cognitive benefits, though more trials are needed for depression.	Variability in methods, publication bias.
5.	Chavivah Davis[25]	Not specified	Narrative review	N/A	Not specified; general emphasis on low doses to avoid full psychedelic effects	Subjective: Self-reported mood, cognition, and creativity assessments	Enhances mood, cognition, and creativity; legality limits research scope.	Highlights mental health potential; warrants legal reform to support research.	Mostly anecdotal data limited empirical basis.
6.	Kiilerich et al.[26]	Animal study (rats)	Preclinical, animal study	N/A	Repeated low doses, frequency controlled in a lab setting	Objective: Behavioural assessments (stress resilience, self-grooming, locomotor activity), neurobiological measures (5-HT7 receptor expression, synaptic density)	Repeated low doses of psilocybin improved resilience to stress, reduced compulsive-like behaviours, and increased synaptic density in the paraventricular nucleus of the thalamus without desensitising 5-HT2A receptors.	Suggests a physiological basis for stress resilience in response to microdosing.	Limited applicability to humans; preclinical study.
7.	Cavanna et al.[27]	34 participants	Double-blind, placebo-controlled study	N/A	0.5 grams of dried psilocybin mushrooms (Psilocybe cubensis) administered as a single low-dose	Subjective: Self-reported experience, creativity (divergent and convergent thinking); Objective: EEG (theta band power), signal complexity	Reduced EEG theta power; no significant cognitive or creativity improvements observed.	Highlights the need for larger studies to confirm cognitive effects.	The sample size was small, and there was no evidence of substantial cognitive benefit.
8.	Cameron et al.[28]	Male and female Sprague Dawley rats	Preclinical research	N/A	Chronic, intermittent low doses of DMT administered over a period	Objective: Behavioural assessments (mood, anxiety, memory, social interaction); physiological measures (weight gain)	Chronic, intermittent DMT microdosing produced antidepressant-like effects and improved fear extinction learning in rats without impacting memory or social behaviour.	Suggests potential for mood and anxiety benefits, though human trials are needed.	Findings are limited to animals; human applicability is unclear.
9.	Kaertner et al.[29]	81 participants	Prospective design	4 weeks	Weekly microdosing regimen	Self-reported measures of psychological well-being, emotional stability, anxiety, and depressive symptoms; positive expectancy scores	Increased self-reported psychological well-being, emotional stability, and reductions in anxiety and depressive symptoms; positive expectancy scores predicted improvements in well-being, indicating a placebo effect.	Strong clinical evidence for emotional regulation benefits.	Small sample size; only 4-week duration.

(Continued)

Study	Authors	Participants	Study Design	Duration	Microdosing Methodologies (Dosage and Frequency)	Subjective and Objective Measurements	Key Findings	Implications	Limitations
10.	Ona and Bouso[30]	Various studies reviewed	Systematic review	N/A	Sub-behavioural doses of LSD or psilocybin; heterogeneity in dosing schedules and drug types	Assessments of mood, creativity, energy, and safety; potential placebo effects	Evidence shows both benefits and detriments of microdosing regarding mood enhancement, creativity, and energy; inconsistent findings highlight the role of placebo effects.	Points to need for improved study design in future research.	Variability in studies limits reliability; placebo effects.
11.	Hutten et al.[31]	24 healthy participants	Placebo-controlled within-subject	Up to 6 hours post-administration	Three doses of LSD (5, 10, and 20 micrograms); placebo administered	Psychomotor Vigilance Task, Digit Symbol Substitution Test, Cognitive Control Task, POMS, 5-Dimensional Altered States of Consciousness scale.	Positive effects on mood and cognition, particularly at 20 micrograms for mood enhancement and friendliness; negative effects included increased confusion and anxiety, especially at 20 micrograms.	Highlights the potential for low doses of LSD to enhance mood and cognition while indicating a need for caution due to possible negative effects at higher doses.	The sample size was relatively small, and the study's within-subject design may not account for individual variability in responses to LSD. Additionally, the effects were assessed only up to 6 hours post-administration, potentially missing longer-term effects.
12.	Cameron et al.[32]	2,347 respondents	Cross-sectional survey	N/A	Sub-hallucinogenic doses, frequency not specified	Self-reported changes in mood, cognitive function, social interaction, and physiology	Reported improvements in mood, anxiety, memory, and social interactions.	Indicates widespread use and perceived benefits among young adults.	Self-reported data limit reliability; legal risks are noted.
13.	Various authors	N/A	Narrative comparison	N/A	Not specified: comparison to standard doses of SSRIs, benzodiazepines	N/A (Review)	Faster anxiety relief than SSRIs, complementary to mindfulness and exercise.	A potential alternative for rapid anxiety relief with fewer side effects.	Lack of RCTs for direct comparisons to traditional treatments.

Note: This table provides a comprehensive overview of various studies examining the effects of Psilocybin microdosing on mental health, mood, cognition, creativity, and safety. Each study is categorised based on specific themes, including subjective experiences, psychological risks, and improvements in mental health. The findings highlight the potential benefits and limitations associated with microdosing psychedelics, particularly psilocybin, while emphasising the need for further research to establish long-term effects and safety profiles.

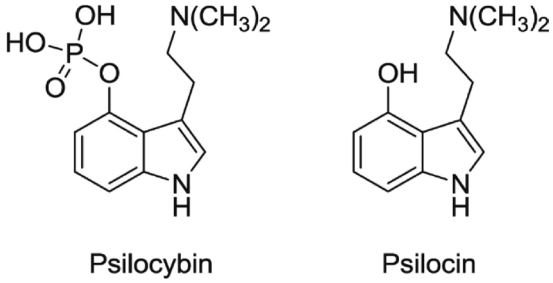

Fig 1 | Mechanisms of psilocybin microdosing in anxiety relief

Source: Gregorio et al. (2018)[13]

to the lasting benefits patients often report beyond the immediate effects of a single dose.[12–19]

Long-Term Mechanisms in Psychiatric Treatment

Recent studies suggest psilocybin's efficacy in psychiatric disorders such as treatment-resistant depression. It shows sustained symptom reduction in patients after its use. Its therapeutic actions involve immediate receptor-mediated effects followed by longer-term changes in neural circuits. This dual-phase impact supports persistent improvements in mood and cognitive function.[11–14]

Differences Between Microdosing and Therapeutic Doses

Microdosing and therapeutic dosing of psilocybin serve distinct purposes. Both forms differ primarily in dosage, frequency, and the effects they cause. Microdosing typically involves ingesting sub-perceptual doses of psilocybin, usually between 0.1 and 0.3 grams of dried psilocybin mushrooms or 1/10th to 1/20th of a standard dose.[17–22] This minimal amount is administered every few days over a longer period. It is intended to provide subtle enhancements to mood, cognition, and focus without producing hallucinations or intense psychoactive experiences. The benefits of microdosing are cumulative as users report improvements in anxiety and emotional resilience.[20]

In contrast, therapeutic dosing involves a significantly larger dose, typically between 20 and 30 milligrams of psilocybin.[21] This dose is administered in a controlled single session within a supervised

DOI: https://doi.org/10.70389/PJS.100036 | Premier Journal of Science 2024;1:100036

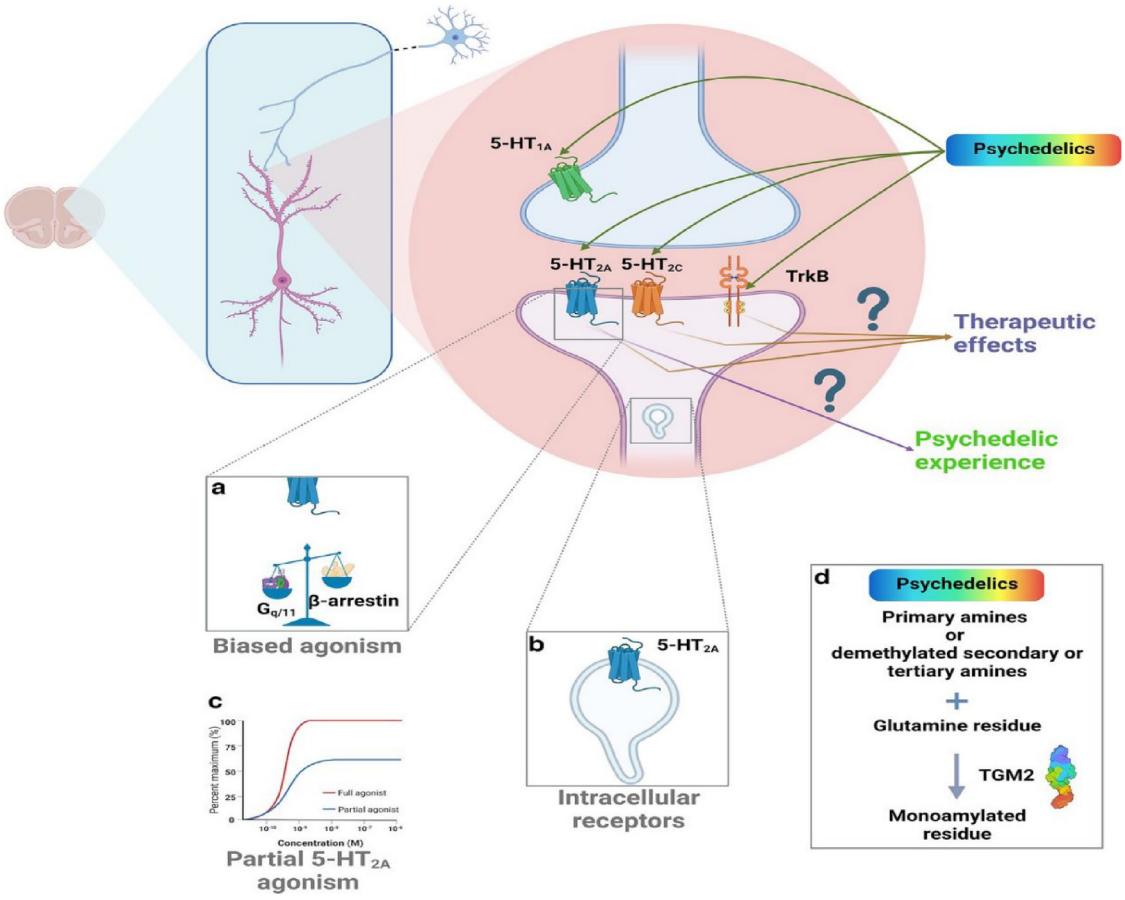

Fig 2 | Psilocin binds with high affinity to 5-HT2A and 5-HT2C receptors

Source: Cameron et al. (2023)[19]

therapeutic setting.[22] This dose induces profound perceptual shifts, such as visual and auditory alterations. It also induces a sense of ego dissolution and heightened introspection. These effects are generally short-lived and last between four and 6 hours.[20–22] However, the psychological and emotional insights gained from microdosing can improve mental health. This improvement can help individuals with treatment-resistant depression and anxiety. Therapeutic dosing is often accompanied by psychological support to guide the patient through the experience and facilitate deeper insights. Both dosing strategies have been explored for mental health benefits. However, microdosing is considered a day-to-day mood and productivity enhancer.[14–20]

Microdosing Methodologies

Dosage Variations and Frequency Used in Studies

In clinical research, microdosing methodologies vary in terms of dosage and frequency of administration.[22] Microdoses of psilocybin range from 0.1 to 0.5 grams of dried mushrooms. It is approximately 1/10th to 1/20th of a standard therapeutic dose.[22–24] Studies have reported various dose regimens; some protocols recommend administration every 3 days.[27] Others suggest a more flexible schedule that allows users to self-titrate based on their subjective experiences and desired outcomes.[24] Fadiman (2011) advocated a 'one-day-on, two-day-off' approach.[20] The chosen frequency emphasises the importance of sustained effects over a longer period. However, many studies focus on the acute impacts of more frequent dosing.[18–22]

Comparison of Subjective and Objective Measurements

Researchers employed subjective and objective measurement methodologies to assess the effects of microdosing.[9–20] Subjective measurements typically include self-reported questionnaires and rating scales that capture participants' experiences, mood changes, cognitive enhancements, and overall well-being. Tools such as the profile of mood states (POMS) and the beck anxiety inventory (BAI) are frequently used to evaluate emotional states and psychological changes associated with microdosing.[21–23,25,27,29,30–34]

Objective measurements often involve physiological and neurobiological assessments to quantify the effects of psilocybin at a more measurable level.[26–28,30,31] These measures included neuroimaging techniques such as functional magnetic resonance imaging (fMRI) to observe changes in brain activity or connectivity

patterns.[26–31] Physiological markers like heart rate variability and cortisol levels are also used to provide insights into the stress response and overall physiological effects of microdosing.[30–31]

Studies suggest that the integration of subjective and objective data is crucial for gaining an inclusive understanding of the microdosing experience. Subjective data provide valuable insights into the personal and experiential aspects of microdosing.[25–30] Objective measurements help to substantiate claims and reveal underlying neurophysiological mechanisms that may contribute to the observed benefits. The combined approach based on these methodologies can better evaluate the efficacy and safety of microdosing.[30–34]

Microdosing Trends and Popularity

Demographic Insights into Microdosing Among Young Adults

Studies have revealed that microdosing has gained significant traction among young adults within the millennial and Generation Z demographics.[8–12] Recent surveys indicate that individuals aged 18–34 represent a significant portion of the microdosing population. A desire for cognitive enhancement and emotional well-being drives microdosing. This age group often prefers alternatives to traditional pharmaceuticals and favours natural or holistic approaches to mental health and wellness. Research[8–20] has shown that microdosing is particularly prevalent among those with backgrounds in technology and creative industries. The high-stakes environments and performance pressures encourage experimentation with non-traditional methods for boosting productivity and creativity. It is also evident that gender differences have emerged in microdosing trends as women are more likely to engage in microdosing practices. Individuals seeking relief from anxiety and mood disorders or enhanced focus in their personal and professional lives are willing to be involved in microdose therapy.

Cultural and Social Factors Influencing Microdosing Adoption

The growing popularity of microdosing can be attributed to several cultural and social factors. The normalisation of psychedelic use in popular culture has played a significant role in its adoption. A resurgence of interest in mental health and wellness drives this normalisation. Public perception has been shifted through documentaries, podcasts, and books discussing psychedelics' potential benefits in mental health. This shift further reduced stigma and encouraged open conversations about their use. Furthermore, the influence of social media platforms has created communities where individuals share their microdosing experiences and benefits. This sense of community has contributed to the rapid dissemination of information and the establishment of microdosing as a social trend.

Review of Emerging Evidence on Psilocybin Microdosing for Anxiety

A surge in research on the therapeutic potential of psilocybin in anxiety relief has been seen in recent years. Several clinical studies have explored the efficacy of psilocybin microdosing and its impact on anxiety symptoms among various populations.

Health Benefits and Motivations in Psychedelic Microdosing

Rootman et al.[21] investigated the mental health motivations and outcomes among adults using microdose psychedelics. Data from 4,050 microdosers and 4,653 non-microdosers were collected via a mobile app, and mental health effects were explored. Psilocybin was identified as the most frequently used substance. Microdosers were engaged in diverse dosing routines and sometimes combined psilocybin with substances like Lion's Mane mushrooms, chocolate, or niacin. The demographics between microdosers and non-microdosers were similar, but microdosers have a history of mental health concerns. They reported lower levels of depression, anxiety, and stress compared to non-microdosers. Health and wellness were primary motivators, especially among females and individuals with mental health issues. The study underscores the mental health benefits associated with microdosing and emphasises the need for further longitudinal research on its mental health impacts.

Psilocybin Microdosing for Mindfulness and Anxiety

Hartong and van Emmerik[22] explored the relationship between psilocybin microdosing and anxiety, focusing on the role of mindfulness. Their cross-sectional study included 186 current microdosers, 77 former microdosers, and 234 microdose-naïve controls who completed anonymous online questionnaires. The researchers measured trait anxiety using the State-Trait Anxiety Inventory and mindfulness through the Five-Facet Mindfulness Questionnaire. Results indicated that both current and former microdosers reported lower anxiety levels compared to controls. Additionally, trait mindfulness partially mediated the relationship between psilocybin microdosing and anxiety, particularly through non-judging and non-reactivity facets of mindfulness. However, the associations became insignificant in an exploratory analysis, excluding participants with prior macrodose experiences.

Improvements in Mood and Mental Health with Psilocybin Microdosing

Rootman et al.[23] conducted a study on psilocybin microdosing with self-administration of small doses of psilocybin mushrooms. The study included 953 psilocybin microdosers and 180 non-microdosing controls over 30 days. Results showed that microdosers experienced small- to medium-sized mood and mental health improvements compared to controls. These improvements were consistent across various demographics,

DOI: https://doi.org/10.70389/PJS.100036 | Premier Journal of Science 2024;1:100036

including gender and age, and were also observed among individuals with pre-existing mental health concerns. Moreover, older adults exhibited enhancements in psychomotor performance. The study found no significant effects on mood and mental health from combining psilocybin with lion's mane mushrooms and niacin. However, for older microdosers, this combination was linked to greater psychomotor improvements compared to other dosing regimens.

Therapeutic Potential of Psilocybin Microdosing in Depression

Kuypers[24] conducted a review on the microdosing of LSD and psilocybin. The review aimed to evaluate the scientific basis for using microdosing as a treatment for affective disorders such as depression. The findings indicated that low doses of LSD and psilocybin produced subtle positive effects on cognitive processes and brain areas associated with mood. Some participants reported increased anxiety and fluctuations in mood. Importantly, low doses were generally well tolerated with minimal physiological effects. It suggests that the therapeutic value of microdosing for depression remains uncertain, but the observed cognitive flexibility might help reduce rumination.

Enhance Mood and Cognition with Microdosing

Davis[25] explored the effects of microdosing with psilocybin. This study highlighted its potential to enhance mood, cognition, and creativity without inducing a full psychedelic experience. They also discussed the illegality of psilocybin and the limited scope of research, which present risks and concerns that warrant attention. Their review suggested that psilocybin has efficacy in certain mental disorders.

Psilocybin Microdosing Enhances Stress Resilience

Kiilerich et al.[26] investigated the effects of repeated low doses of psilocybin, focusing on the potential benefits of microdosing. This study established a regimen of psilocybin administration in rats. The rats tolerated these low doses well, exhibiting no signs of anxiety, anhedonia, or altered locomotor activity. Moreover, the treatment did not lead to downregulation or desensitisation of the 5-HT2A receptors involved in psychedelic effects. Notably, the microdosing regimen imparted resilience against stress induced by multiple injections. Additionally, the treatment increased the expression of the 5-HT7 receptor and synaptic density in the paraventricular nucleus of the thalamus. These findings support the therapeutic benefits of psilocybin microdosing and suggest a physiological mechanism underlying these effects.

Psilocybin Microdosing for Enhanced Creativity and Cognitive Function

Cavanna et al.[27] conducted a double-blind, placebo-controlled study on the effects of psilocybin microdosing involving 34 participants. Participants received either a dose of 0.5 grams of dried mushrooms or a placebo. Those who identified their condition reported stronger acute effects from the active dose. It is reflected in reduced EEG theta power. However, the study found no substantial evidence for improvements in well-being, creativity, or cognitive function. However, some measures indicate mild improvement in cognitive impairment.

Positive Mood and Anxiety Effects of DMT (Psilocybin) Microdosing

Cameron et al.[28] investigated the effects of chronic and intermittent low doses of *N*, *N*-dimethyltryptamine (DMT) found in psilocybin on rats. It assessed the potential benefits of microdosing on mood and anxiety. The results showed that repeated low doses of DMT produced an antidepressant-like effect and enhanced fear extinction learning. Interestingly, male rats also experienced significant weight gain during the study. These findings suggest that psilocybin microdosing may have positive effects on mood and anxiety disorders.

Anxiety and Emotional Regulation

Kaertner et al.[29] shed light on the complexities of psychedelic microdosing and its impact on mental health outcomes. This prospective study involved 81 participants in a weekly microdosing regimen over 4 weeks. They measured a range of subjective and objective mental health outcomes. One of the key findings of this research is the significant role of positive expectancy in predicting mental health outcomes. Anxiety levels were measured using standardised psychological assessment tools, including the BAI. Participants reported a significant reduction in anxiety levels.

Placebo Effects in Microdosing Psychedelics

Ona and Bouso[30] conducted a systematic review of the safety, efficacy, and role of the placebo effect in microdosing psychedelics, including LSD and psilocybin. These psychedelics have gained popularity in Western societies for perceived mood and creativity enhancement. Their review synthesises data from human studies with large sample sizes and presents promising and conflicting findings on microdosing's impact on mood, creativity, and energy. The review highlights limitations such as gender bias and inconsistencies in dosing regimens and substances. The review discusses the significant role of the placebo effect, revealing how it may influence perceived benefits.

Mood Improvement and Enhanced Brain Connectivity

A study by Hutten et al.[31] examined the effects of psilocybin microdosing on individuals with treatment-resistant depression and anxiety. This placebo-controlled study included 24 healthy participants. Three doses of LSD (5, 10, and 20 micrograms) were administered, and various cognitive and mood assessments were conducted up to 6 hours post-administration. Subjective and objective measures were used, including mood assessments. Results showed a significant reduction in symptoms of anxiety and depression.

However, the study also identified negative effects, such as increased confusion and anxiety, particularly at higher doses.

Subjective Effects of Psychedelic Microdosing

Cameron, Nazarian, and Olson[32] surveyed to explore the prevalence and subjective effects of psychedelic microdosing among young adults. Their study found that the regular intake of sub-hallucinogenic doses of psychedelics has gained popularity for its potential benefits in mood improvement, anxiety reduction, and cognitive enhancement. Data from 2,347 respondents revealed that 59% were familiar with microdosing, while 17% had actively engaged in it. Microdosers reported perceived improvements in mood, reduced anxiety, and enhanced memory, attention, and social interactions. However, a notable number of participants discontinued microdosing due to legal risks and difficulties obtaining psychedelic substances. These findings suggest that psychedelic microdosing is common and is linked to a range of socio-affective, cognitive, and physical effects according to self-reported experiences.

Comparative Effectiveness with Other Treatments

Psilocybin microdosing has emerged as a compelling alternative to traditional pharmacological treatments, particularly selective serotonin reuptake inhibitors (SSRIs) and benzodiazepines.[12–16] Each treatment modality offers unique benefits and drawbacks that warrant careful consideration. SSRIs often require weeks of consistent use to reach therapeutic levels, but psilocybin microdosing tends to yield more immediate effects. Users commonly report rapid improvements in mood and anxiety management shortly after ingestion. This immediacy can be particularly beneficial for individuals seeking urgent relief from anxiety symptoms.[18–22]

Benzodiazepines are frequently prescribed for acute anxiety relief due to their fast-acting nature. However, their long-term use can pose significant risks, including dependence, tolerance, and withdrawal symptoms. Psilocybin microdosing has shown a lower potential for misuse and addiction.[18–23] Users typically do not develop a tolerance to psilocybin, which allows sustained efficacy without escalating doses. Clinical trials involving psilocybin have reported fewer and less severe side effects compared to traditional treatments.[22–28] Benzodiazepines cause sedation, cognitive impairment, and motor skill deficits. Psilocybin microdosing is often associated with minimal adverse effects like mild gastrointestinal discomfort.[25,26]

Psilocybin microdosing is increasingly compared to various alternative treatments for anxiety, including meditation and exercise. Meditation practices, including mindfulness and focused attention techniques, have demonstrated efficacy in reducing anxiety and enhancing emotional well-being.[15–21] Microdosing psilocybin combined therapy may augment these effects by enhancing cognitive flexibility and emotional insight. Studies reported heightened mindfulness and introspection among users while microdosing.[24–26] The neurobiological action of psilocybin and its impact on serotonin receptors complement the brain changes induced by meditation. Moreover, Psilocybin microdosing enhances motivation and enjoyment associated with physical activity. Users frequently report that microdosing allows them to engage more fully in exercise routines.[30–33]

Discussion

Mechanism of Action in Anxiety Relief

Psilocybin microdosing has gathered medical attention as a potential therapeutic approach for anxiety relief. Primarily due to its nuanced effects on serotonin pathways, mood regulation, and neuroplasticity.

Effects on Serotonin Pathways

After administration, psilocybin converts to its active derivative, psilocin. It is an effective agonist of the 5-hydroxytryptamine 2A (5-HT2A) receptor.[11] This receptor is a critical component of the serotonergic system and significantly regulates mood and emotional responses. Psilocybin may facilitate improved mood and reduced anxiety levels by enhancing serotonergic activity. Preliminary research[12] suggests that microdoses of psilocybin can increase serotonin receptor availability and downstream signalling. This process may help balance neurotransmitter systems involved in anxiety regulation.[13,14]

Mood Regulation

The modulation of mood is another key factor in the efficacy of psilocybin microdosing for anxiety relief. Studies have shown that psilocybin may influence brain regions associated with emotional processing, particularly the prefrontal cortex and amygdala.[10] Studies[11–15] suggest that modulating activity in the amygdala psilocybin helps alleviate excessive emotional responses. Therefore, it can offer relief from symptoms of anxiety and mood disorders. Some studies[14,15] also suggest that psilocybin enhances communication between the cortex and thalamus, improving sensory integration and connectivity across neural networks. This mechanism has a more uniform effect on the nervous system. This interaction enhances emotional regulation and decreases hyperactivity in areas typically overactive during anxiety episodes, promoting a sense of calm.[17,18] Enhanced emotional insight and introspection resulting from microdosing also contribute to an individual's ability to process anxiety-provoking situations more effectively.[19]

Neuroplasticity

Enhanced neural plasticity is another mechanism linked to psilocybin's therapeutic effects. Psilocybin promotes the brain's ability to form new connections and reorganise itself.[16] Research indicates that psilocybin also promotes neurogenesis and synaptogenesis. Neurogenesis is the process of generating

DOI: https://doi.org/10.70389/PJS.100036 | Premier Journal of Science 2024;1:100036

new neurons and enhancing brain plasticity. Neurogenesis is essential for adapting to changing environments and recovering from stress.[26,27] Preclinical studies have indicated that psilocybin can stimulate the production of brain-derived neurotrophic factor (BDNF).[29–31] It is a protein that plays a critical role in the survival of existing neurones and encouraging the growth of new ones. Elevated BDNF levels have been associated with improved mood and cognitive functions.[30–33]

Psilocybin has been shown to enhance synaptogenesis, forming new synaptic connections between neurons. Increased synaptic connectivity can improve communication within neural circuits implicated in emotional regulation involving the amygdala and prefrontal cortex.[14–18] Microdosing may help individuals rewire maladaptive thought patterns and emotional responses, mitigating anxiety symptoms over time. This enhancement of neural adaptability may result in emotional resilience and enable individuals to navigate anxiety-provoking experiences.[20–22] Recent studies have revealed that psilocybin may activate downstream signalling pathways through receptors like 5-HT1A and 5-HT2C. This activation influences cellular functions such as protein synthesis, supporting mood and cognitive flexibility. Enhanced neuroplasticity may drive the therapeutic insights often reported by patients and contribute to sustained benefits beyond the immediate effects of a single dose.[18–26]

Comparison with Traditional Anxiolytics

There are many differences between psilocybin microdosing and traditional anxiolytics. Traditional anxiolytics such as benzodiazepines primarily function by enhancing the effects of the neurotransmitter gamma-aminobutyric acid. It causes sedation and helps reduce anxiety. However, studies also reported that these medications can produce dependency, tolerance, and withdrawal symptoms, limiting their long-term utility.[21,23] In contrast, psilocybin microdosing offers a potentially safer alternative by targeting serotonin receptors. This targeting influences mood regulation without the sedative side effects commonly associated with traditional anxiolytics. Furthermore, psilocybin's impact on neuroplasticity may offer long-term benefits and help to address the root causes of anxiety rather than merely masking symptoms.[33,34]

Psychological Impacts of Psilocybin

Cognitive Enhancement

Research suggests psilocybin may enhance cognitive flexibility, allowing individuals to approach problems and challenges with renewed perspectives. Users often report improvements in creative thinking, problem-solving abilities, and enhanced pattern recognition.[23–25] This cognitive enhancement can facilitate a more open-minded and exploratory approach to life. It may help in navigating complex emotional landscapes associated with anxiety and stress.[20]

Mindfulness and Present-Moment Awareness

Microdosing psilocybin can increase mindfulness and awareness of the present moment. Studies reported that patients experience heightened sensory perception and an enhanced connection to their surroundings.[21–23] It helped them to feel a greater appreciation for everyday experiences. This heightened awareness encourages individuals to engage more fully in the present.[24] This mindfulness aids in reducing rumination and anxiety. Therefore, psilocybin microdosing helps individuals manage their emotional responses effectively and cultivate a sense of calm amidst life's challenges.[32]

Emotional Regulation

Psilocybin's action on emotional regulation is particularly noteworthy. It interacts with serotonin receptors and helps balance mood and reduce emotional dysregulation.[29] Many studies[21,22,29,31] reported an increased ability to process and articulate their emotions. It helped them to a greater understanding of their mental states and triggers. This emotional insight can empower individuals to confront anxiety-inducing situations with improved resilience and coping strategies.

Long-Term Versus Short-Term Impacts of Microdosing

The psychological impacts of psilocybin microdosing can vary significantly between short-term and long-term experiences.

Short-Term Impacts

Microdosing's short-term impact is associated with immediate enhancements in mood, creativity, and emotional well-being. Studies reported increased sociability, improved energy levels, and reduced anxiety, which provide relief from daily stressors. These acute effects may contribute to a temporary uplift in quality of life and can catalyse personal insights and emotional breakthroughs.[25,27,28,32] Microdosing psilocybin has been reported to induce subtle yet impactful changes in perception and cognition. Users often describe enhanced creativity and improved problem-solving abilities. These cognitive shifts may allow individuals to approach anxiety-provoking situations from new perspectives.[24,25,31,32] Furthermore, microdosing can heighten self-awareness and introspection.[24,25,28] By fostering a deeper understanding of one's thoughts and emotions, individuals may be better equipped to recognise anxiety triggers and modify maladaptive responses.

Long-Term Impacts

The long-term impacts of psilocybin microdosing extend beyond the immediate effects. Emerging evidence suggests that consistent microdosing leads to sustained improvements in mental health. It can reduce anxiety and depression, enhance emotional resilience, and lasting changes in cognitive patterns.[21,23,24,26,29,31] Cameron et al.[32] reported that

patients experienced a deeper sense of connection with themselves and others. This connection fosters a positive relationship and a greater sense of purpose. Furthermore, regular microdosing could promote neuroplasticity and enable individuals to establish new, healthier mental habits and thought patterns. This ongoing transformation provides enduring benefits that persist long after the microdosing regimen has concluded.[28,29,31]

Potential Risks and Adverse Effects

Psychological Risks Associated with Microdosing

While psilocybin microdosing has gained popularity for its potential benefits, it is essential to consider the associated psychological risks. Some studies.[23,24,29,30] have reported that patients experience heightened anxiety or distress, particularly in mental health disorders, including schizophrenia or bipolar disorder.[31,32] The psychoactive properties of psilocybin can exacerbate these pre-existing conditions. It led to episodes of paranoia, increased mood instability, or psychotic symptoms. It has also been reported that the subjective experience of microdosing can vary significantly among patients, with some reporting feelings of unease or discomfort. The finding suggests that the lack of standardisation in dosage and frequency can lead to unpredictable effects and increase the likelihood of adverse psychological responses. Therefore, it is crucial to approach microdosing under clinical guidance to mitigate these risks.[23,24,26,31,32]

Known Adverse Effects from Clinical Trials and Anecdotal Evidence

Clinical trials and anecdotal reports have identified various adverse effects associated with psilocybin microdosing. Common short-term effects include physiological reactions such as mild headaches, nausea, and gastrointestinal discomfort shortly after ingestion.[24–26,30,31] These symptoms are generally transient but can detract from the overall experience. Some patients may also encounter fluctuations in mood, irritability, or emotional overwhelm during or shortly after microdosing sessions.[24–27] While many patients have reported positive outcomes, some have reported experiencing negative emotional responses. They reported increased anxiety or depressive symptoms, particularly if the microdosing regimen is not appropriately managed. Most clinical research has reported that the safety profile of psilocybin is favourable, with few serious adverse effects. However, some participants in clinical trials have noted temporary alterations in perception, increased introspection, and occasional disturbances in thought processes. These effects can vary in intensity and may pose challenges for individuals unprepared for such experiences.[24,30,31]

Challenges and Limitations in Research

Research on psilocybin microdosing faces several challenges and limitations. Small sample sizes and inadequate study designs hinder many studies. These induce biases, which can compromise the validity of findings. Controlling for placebo effects also poses significant challenges, as participants' expectations can significantly influence outcomes in psychedelic research. Ethical and legal barriers also impact research opportunities. Psilocybin has an illegal status in many regions that restricts its access and research funding. Furthermore, ethical concerns regarding the administration of psychedelics in clinical settings raise questions about participant safety and informed consent. Finally, the current research lacks long-term studies on the efficacy and safety of psilocybin microdosing.

Ethical Considerations and Future Directions

Several ethical concerns must be addressed during psilocybin microdosing to ensure safe and responsible practices. These ethical considerations involve multiple dimensions, including participant safety, informed consent, accessibility, and societal impact. The absence of standardised protocols leaves a gap in ensuring safe and reproducible dosing practices. In clinical trials, well-defined dosing and monitoring guidelines are essential to protect participants from adverse effects. Researchers must clearly communicate both known risks and the limitations of current evidence to ensure truly informed consent. Moreover, microdosing exists in a legal grey area in many jurisdictions and requires developing consistent regulatory frameworks to promote equitable access to potential treatments. The cultural and societal implications of normalising microdosing must also be considered.

Future research on psilocybin microdosing should prioritise improved study designs needed through randomised controlled trials and double-blind methodologies. Emphasising the importance of diverse and large sample populations can also ensure the credibility of results. Technological innovations hold significant promise in this area. Some neuroimaging techniques, including fMRI and PET scans, can provide insights into the neurobiological effects of microdosing. Biomarker identification may also help to establish physiological indicators of efficacy and safety. Furthermore, artificial intelligence can play a crucial role in analysing large datasets. It can help uncover patterns and correlations that might not be apparent through traditional statistical methods. Policy implications are also important, and a shift towards more permissive attitudes regarding psychedelic research is suggested. The approval and reclassification of psilocybin from a controlled substance can facilitate its integration into clinical practice.

Clinical and Therapeutic Implications

The evidence suggests promising therapeutic applications of psilocybin microdosing for anxiety treatment. Its unique mechanism of action enhances mood regulation, neuroplasticity, and emotional resilience. Integrating psilocybin microdosing into current mental health treatment protocols could provide an

DOI: https://doi.org/10.70389/PJS.100036 | Premier Journal of Science 2024;1:100036

alternative and complementary approach for individuals who have not responded adequately to conventional therapies. Practitioners should be encouraged to develop microdosing guidelines facilitating informed decision-making for young adults. Raising awareness of the psychological risks associated with unsupervised use is crucial in fostering safe practices. It can aid in developing evidence-based strategies for managing anxiety and improving mental health outcomes among younger populations.

Conclusion

This study reviewed the emerging evidence supporting the use of psilocybin microdosing for anxiety relief in young adults. The findings suggest that psilocybin microdosing may improve mood, emotional regulation, and overall mental well-being. Its unique neurobiological mechanisms and psychological effects facilitate its therapeutic effect. It could significantly reduce reliance on traditional anxiolytics, which carry high dependency and withdrawal risks. This shift may offer a safer, more sustainable option for long-term anxiety management, benefiting both individual and public health. However, it is crucial to acknowledge the limitations inherent in the current research. Small sample sizes, methodological inconsistencies, and the challenges associated with placebo effects limit the generalizability. Continued research efforts are essential to establish standardised protocols and evaluate the long-term safety and efficacy of psilocybin microdosing.

Availability of Data and Materials

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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