PTSD treatment: An Inquiry into the Promising Potential of Psilocybin

Abstract

Post-Traumatic Stress Disorder (PTSD) is a debilitating mental health condition that can occur after experiencing or witnessing a traumatic event. The impact of PTSD extends beyond the individual, affecting families, communities, and society as a whole. This study aims to investigate the potential of psilocybin as a treatment for PTSD. Psilocybin, after being metabolized to psilocin, binds to various serotonergic receptors to exert some major effects such as a reduction in negative mood and an increase in optimism, enhanced ability for introspection and perceptual changes, a reduction in amygdala reactivity during emotion processing, and—as has been found in animal studies—an extinction of the fear response and increased hippocampal neurogenesis. However, Psychedelics such as psilocybin may lead to brief episodes of nausea, vomiting, and physical discomfort. This study indicated that there is an urgent need for innovative therapies that could enhance the effectiveness of PTSD treatments. As this review highlights, psilocybin and some other psychedelics offer prospects for a revolutionary method of treating PTSD. They can swiftly and directly address PTSD symptoms and can also be used as an adjunct to psychotherapy.

Introduction

Post-Traumatic Stress Disorder (PTSD) is a debilitating mental health condition that can occur after experiencing or witnessing a traumatic event. According to the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association), PTSD is characterized by intrusive thoughts, avoidance behaviors, negative alterations in cognition and mood, and hyperarousal symptoms. These symptoms can significantly impair an individual's daily functioning and quality of life. PTSD has a substantial global impact, affecting individuals from various backgrounds and ages, including military personnel, first responders, and survivors of abuse, accidents, or natural disasters (Karestan C. Koenen et al.).

The impact of PTSD extends beyond the individual, affecting families, communities, and society as a whole. Individuals with PTSD often experience difficulties in interpersonal relationships, social functioning, and occupational performance (Davidson). Furthermore,

PTSD is associated with an increased risk of comorbid conditions such as depression, substance abuse, and physical health problems, resulting in a substantial economic burden on healthcare systems and lost productivity (Ronald C. Kessler).

Traditional treatments for PTSD have primarily focused on psychotherapy and pharmacotherapy. Cognitive-behavioral therapies (CBT), such as prolonged exposure therapy and cognitive processing therapy, have been widely used to help individuals process traumatic memories and restructure maladaptive thoughts and beliefs (Ulrich Schnyder et al.). However, these approaches have limitations, including high dropout rates, limited efficacy for some individuals, and the potential for symptom exacerbation during exposure-based treatments (Steenkamp et al.). Pharmacological interventions, such as selective serotonin reuptake inhibitors (SSRIs) and other antidepressants, have also been utilized in the management of PTSD symptoms. While these medications can provide symptomatic relief, they often have limited efficacy in addressing the underlying traumatic memories and may be associated with severe adverse effects (Hoskins et al.).

In recent years, there has been a growing interest in exploring novel and innovative approaches to PTSD treatment, particularly psychedelic-assisted therapies. Psychedelics, such as psilocybin (the active compound in magic mushrooms), have shown promising potential in various clinical trials and research studies (Reiff et al.).

Psilocybin, a naturally occurring psychedelic compound, has shown promising results in reducing symptoms of PTSD, depression, and anxiety. Psilocybin-assisted therapy is believed to promote neuroplasticity, facilitate the processing of traumatic experiences, and foster psychological flexibility and emotional regulation (Davis et al.).

While the use of psychedelics in therapeutic settings is still in its early stages, the emerging research has sparked renewed interest and debates within the scientific community and broader society. Proponents argue that these substances, when used in controlled and supervised settings, may offer novel and potentially more effective treatments for individuals suffering from PTSD and other mental health conditions that have been resistant to conventional treatments (Mithoefer et al.; Reiff et al.).

The recent decision by the U.S. Food and Drug Administration (FDA) to reject 3,4-methylenedioxymethamphetamine (MDMA)-assisted psychotherapy for PTSD treatment (Reardon) highlights the challenges in developing novel therapies. On June 4, 2024, the Psychopharmacologic Drugs Advisory Committee of the U.S. FDA voted against the application, citing concerns regarding efficacy, safety, and human abuse potential. Specifically, the FDA raised issues with expectation bias, durability of treatment, and the role of psychotherapy in assessing efficacy. Additionally, the agency expressed concerns about inadequate safety data, limited clinical trial data, and the lack of information on MDMA's positive effects. This setback underscores the need to explore alternative psychedelic treatments, such as psilocybin, in the pursuit of effective solutions for PTSD.

Hence, the objective of this review study is to critically examine the potential of psychedelic-assisted therapies, specifically psilocybin as novel and promising treatments for PTSD. Since many individuals with PTSD continue to experience persistent symptoms despite the availability of traditional therapies, this highlights the need for more effective and innovative treatment approaches. By conducting a literature review, this study aims to synthesize the existing evidence from clinical trials and research studies to critically examine the utilization, efficacy, challenges, risks, and ethical considerations associated with psychedelic-assisted therapies for PTSD. Ultimately, the goal is to contribute to the ongoing discourse and provide insights that can inform future research directions and the development of novel therapeutic interventions for individuals suffering from this debilitating mental health condition.

Psychedelics: A Brief History and Therapeutic Potential

Native Americans have been using psychedelics for millennia; the first documented usage of these plants' dates to 5700 years ago, and they were utilized in sacred ceremonies in Northeastern Mexico (Bruhn et al.). Psychedelics were introduced to the western world by Arthur Heffner when he separated mescaline components from peyote cactus in 1897. In 1938, Albert Hoffman produced lysergic acid diethylamide (LSD). In 1958, Albert Hoffman also extracted and produced psilocybin (Moreno; Rucker et al.). The LIFE Magazine first used the term "magic mushrooms" in 1957 (Wasson). There was a rather open approach to the usage and regulation of magic mushrooms, LSD and mescaline until 1967, when the United Nations designated all psychedelics as Schedule I drugs, thereby removing them from the market and making them almost impossible to purchase (McNulty). This was due to illicit use and a larger amount of the population misusing and abusing it, questioning their effectiveness and safety. However, underground research was still pursued.

The early 1990s saw a resurgence in interest in psychedelics (Strassman). According to a 2006 study (R. R. Griffiths et al.), those who had psychedelic experiences said they were among the top five most significant, meaningful, and influential events of their lives, ranking on par with the birth of a child. Subsequently, psychedelic research has progressively resumed. There are currently over 60 ongoing psilocybin clinical trials overseen by the United States National Institute of Health (*National Institutes of Health - an Overview | ScienceDirect Topics*).

Psychedelics are substances that cause hallucinations and change cognitive functions. Psychedelic medications can be broadly classified into two groups: synthetic drugs and entheogens. Synthetic psychedelics are made in a lab, whereas entheogenic psychedelics come from plants. Entheogenic psychedelics are Psilocybin (from mushrooms), DMT (from plants, animals even humans), Ayahuasca (source of DMT), Mescaline (from Peyote cactus) and Ibogaine (from *tabernanthe iboga* plant. Synthetic

psychedelics are synthetic drugs such as LSD (from fungus found on grains), MDMA (also known as ecstasy) and ketamine (Visual Capitalist).

The mechanism of action of most psychedelic drugs class act as nonselective serotonin agonists, and their psychotropic effects are mostly associated with agonism of the 5-hydroxytryptamine 2A (5-$HT2_A$) receptor subtype. The G protein coupled receptor (GPCR) known as the 5-$HT2_A$ receptor preferentially couples with a Gg-protein, thereby inducing the activation of phospholipase C and initiating a signaling cascade that ultimately activates protein kinase C and mobilizes calcium from intracellular stores (Thomas et al.).

Psilocybin ($C_{12}H_{17}N_2O_4P$), the active component of magic mushrooms, also referred to as shrooms in the street, is an organic phosphate and a tryptamine alkaloid, a tertiary amino acid. Over 200 species of *Basidiomycota* mushrooms have active psilocybin in their caps and stems, which is where tryptamines, which are generated from the amino acid tryptophan, are present (McNulty).

In the western paradigm, the precise long-term medical usefulness of psilocybin in treating mental health issues is still unknown because many clinical trials involving the drug are still in the early stages of development. Yet, early research indicates that psilocybin treatments are successful in treating a variety of conditions, including depression (Goldberg et al.; Roland R Griffiths et al.), Obsessive-Compulsive Disorder (OCD) (Jacobs), quitting smoking (Garcia-Romeu et al.; Johnson et al.), and alcoholism (Bogenschutz et al.). Furthermore, Anderson et al. (B. Anderson et al.) observed a statistically significant improvement in demoralization among elderly long-term AIDS survivors with psilocybin-assisted group therapy.

Psilocybin-Assisted Psychotherapy for PTSD

Psychopharmacology has benefited many with psychiatric disorders, though drugs often fall short of resulting in a cure. Medications can help decrease symptoms, but long-term use has drawbacks. Psychotherapy, especially for PTSD, can be more effective than drugs, but some patients do not respond adequately (Michael C. Mithoefer et al.). Current treatment guidelines for PTSD recommend trauma-focused Cognitive Behavioral Therapy (TF-CBT) and Eye Movement Desensitization and Reprocessing (EMDR) as first-line treatments. However, up to two-thirds do not respond, possibly due to trauma's impact on the patient-therapist alliance (Steenkamp et al.). Access to these treatments is also challenging, as many clinicians lack training. For some, first-line treatments may be unsuitable. Thus, research into new or combination PTSD treatments is needed (Tracey Varker et al.).

Psilocybin, after being metabolized to psilocin (Tracey Varker et al.), binds to various serotonergic receptors (Erwin Krediet et al.) to exert the following effects: a reduction in negative mood and an increase in optimism (Grob et al.), enhanced ability for introspection

and perceptual changes (Passie et al.), a reduction in amygdala reactivity during emotion processing (Rainer Kraehenmann et al.), and—as has been found in animal studies—an extinction of the fear response and increased hippocampal neurogenesis (S. Woodburn et al.). Some drivers for inquiry into its use in PTSD include its success with reducing depressive symptoms in patients with Major Depressive Disorder and in cancer patients with comorbid depression (Davis et al.). Additionally, it has been shown to reduce suicidal ideation (Strumila et al.).

Starting in the 1960s, psychedelic research was largely abandoned in the United States due to regulatory concerns (Hall). However, an agreement was reached between the National Institute on Drug Abuse and the FDA in 1992, which facilitated the resumption of clinical research with classical psychedelics (Nichols). In the year 2000, a group of Johns Hopkins researchers was the first to obtain regulatory approval in the United States to resume research with psychedelics in healthy volunteers who had no previous experience with psychedelics (*Johns Hopkins Center for Psychedelic and Consciousness Research*). Again, in 2021, Johns Hopkins Medicine received the first federal grant for psychedelic research in 50 years (*Johns Hopkins Medicine Receives First Federal Grant for Psychedelic Treatment Research in 50 Years*).

Encouraging results from clinical trials of psilocybin-assisted therapy (PAT) for depression (Davis et al.) and anxiety (Catherine Bird et al.) suggest that PAT may effectively treat PTSD, given the high comorbidity and symptom overlap between PTSD, depression, and anxiety. A pilot study examining psilocybin-assisted therapy for veterans with PTSD has therefore been proposed to evaluate the safety and efficacy of this approach (Alan K. Davis et al.). It will take place within the Wexner Medical Center at The Ohio State University (OSU) in Columbus, Ohio, USA. The aim is to provide insights into the use of psilocybin in treating PTSD and its effectiveness in improving symptoms in veteran populations.

The efficacy and safety of psilocybin has been demonstrated in trials for the treatment of alcohol and tobacco addiction (Bogenschutz et al.; Johnson et al.), major and treatment-resistant depression (R. L. Carhart-Harris et al.; Robin L. Carhart-Harris et al.; Davis et al.), and depression in end of life care (Roland R Griffiths et al.; Grob et al.; Stephen Ross et al.). Preliminary studies on the efficacy of this approach in PTSD have been encouraging, though further research is needed. There are no clinically significant adverse events with psilocybin (Grob et al.), although acute adverse effects such as nausea and mild headaches may be reported (Bogenschutz et al.; Matthew W. Johnson, Johnson, R. Andrew Sewell, et al.). Under clinical supervision, psychedelics can also temporarily increase anxiety, fear, heart rate, and blood pressure. Without careful oversight, these reactions could lead to dangerous behavior like fleeing the study site (Matthew W. Johnson, Johnson, William A. Richards, et al.).

The therapeutic protocols used in psilocybin-assisted psychotherapy typically involve a series of preparation sessions, a psilocybin session, and integration sessions (Michael C. Mithoefer et al.; Stephen Ross et al.). Preparation sessions are crucial to build rapport

and trust, which helps reduce the risk of fear or anxiety during psilocybin sessions (Davis et al.). In these sessions, the participant's life history, current situation, intentions, and expectations for the psilocybin session are discussed. Side effects and skills for navigating these experiences are also covered (Alan K. Davis et al.).

For the psilocybin session, psilocybin is administered in opaque capsules with water. Participants are encouraged to lie on a couch, wear eyeshades, and listen to music. Vital signs and symptoms are assessed at regular intervals. Acute anxiety or panic is handled with reassurance and appropriate treatment if needed. This usually takes 8 hours. At the end, participants complete questionnaires to assess acute subjective experiences, such as mystical experience, psychological insight, and challenging experience. Participants also write a narrative description of the psilocybin session before their next in-person meeting (Alan K. Davis et al.). Integration strategies, such as journaling, meditation, and group therapy, are used to facilitate the processing of emotions and insights gained during the psilocybin experience (Roland R Griffiths et al.).

Challenges and limitations

Federal and state laws have historically restricted research into therapeutic uses of psychoactive drugs for mental illness, largely due to the perception that these drugs pose greater risks than benefits. For many years, the focus has been on the negative effects of psychedelics, overlooking their potential clinical benefits. However, a recent shift in policies and public opinions has created new opportunities for exploring the use of psychoactive drugs like psilocybin in treating PTSD.

Psychedelics such as psilocybin may lead to brief episodes of nausea, vomiting, and physical discomfort. They can also induce anxiety and confusion. Post-therapy, patients may exhibit emotional vulnerability, emphasizing the need for psychological support. Moreover, they can cause tachycardia and hypertension, making them unsuitable for individuals with severe cardiovascular conditions. Nevertheless, when administered under medical supervision, they are generally safe, non-addictive, and do not cause significant adverse effects.

While the potential of psilocybin in treating PTSD is promising, previous research lacks clarity and precision, and there is paucity of PTSD-specific clinical trials. Nevertheless, studies have shown that psilocybin reduces blood flow to the amygdala, indicating a decrease in the fear response. Its acute effects include heightened emotional empathy, increased perceptiveness, and enhanced

acceptance. Despite these insights, the precise pathophysiology of psilocybin, like other psychedelics, is not fully understood, and certain molecular aspects remain to be elucidated.

Conclusion

The prevalence of PTSD ranges from 6-8% in the general public and is significantly higher among veterans. Symptoms can include intrusive thoughts, phobic avoidance, hyperarousal, hypervigilance, irritability, anger, and depression. Conventional treatments typically involve trauma-focused cognitive behavioral therapy and/or medication. While around two-thirds of patients have responded to traditional pharmacotherapy, remission has been observed in 40% or fewer patients. As a result, there is growing interest in researching alternative options such as psilocybin.

It is unequivocal that exposure-based psychotherapy should be the first-line treatment for PTSD. However, PTSD often persists as a chronic condition with high rates of psychological and medical comorbidities. There is an urgent need for innovative therapies that could enhance the effectiveness of PTSD treatments. As this review highlights, psilocybin and some other psychedelics offer prospects for a revolutionary method of treating PTSD. They can swiftly and directly address PTSD symptoms and can also be used as an adjunct to psychotherapy.

The current research suggests that psychedelics like psilocybin hold therapeutic and curative potential for individuals suffering from PTSD. Further research is needed to establish the safety and efficacy of psilocybin and identify the patient profiles for whom these treatments might be most effective. Future studies should review and overcome the methodological and conceptual constraints present in the current literature. They should strive to evaluate the profound effects of these psychedelics on the neural connectivity and neuroanatomy of PTSD patients. Moreover, future research should focus on evaluating the long-term impacts of these treatment modalities.

References

Alan K. Davis, et al. “Study Protocol of an Open-Label Proof-of-Concept Trial Examining the Safety and Clinical Efficacy of Psilocybin-Assisted Therapy for Veterans with PTSD.” *BMJ Open*, vol. 13, no. 5, May 2023, pp. e068884–e068884, https://doi.org/10.1136/bmjopen-2022-068884.

American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders: DSM-5*. 5th edition, American Psychiatric Association, 2013.

B. Anderson, et al. "Psilocybin-Assisted Group Therapy for Demoralized Older Long-Term AIDS Survivor Men: An Open-Label Safety and Feasibility Pilot Study." *EClinicalMedicine*, vol. 27, 2020, p. 100538, https://doi.org/10.1016/j.eclinm.2020.100538.

Bogenschutz, Michael P., et al. "Psilocybin-Assisted Treatment for Alcohol Dependence: A Proof-of-Concept Study." *Journal of Psychopharmacology*, vol. 29, no. 3, Mar. 2015, pp. 289–99. *DOI.org (Crossref)*, https://doi.org/10.1177/0269881114565144.

Bruhn, Jan G., et al. "Mescaline Use for 5700 Years." *The Lancet*, vol. 359, no. 9320, May 2002, p. 1866. *www.thelancet.com*, https://doi.org/10.1016/S0140-6736(02)08701-9.

Carhart-Harris, R. L., et al. "Psilocybin with Psychological Support for Treatment-Resistant Depression: Six-Month Follow-Up." *Psychopharmacology*, vol. 235, no. 2, Feb. 2018, pp. 399–408. *link.springer.com*, https://doi.org/10.1007/s00213-017-4771-x.

Carhart-Harris, Robin L., et al. "Psilocybin with Psychological Support for Treatment-Resistant Depression: An Open-Label Feasibility Study." *The Lancet Psychiatry*, vol. 3, no. 7, July 2016, pp. 619–27. *www.thelancet.com*, https://doi.org/10.1016/S2215-0366(16)30065-7.

Catherine Bird, et al. "Psilocybin and MDMA for the Treatment of Trauma-Related Psychopathology." *International Review of Psychiatry*, vol. 33, no. 3, June 2021, pp. 229–49, https://doi.org/10.1080/09540261.2021.1919062.

Davidson, Jonathan R. T. "Trauma: The Impact of Post-Traumatic Stress Disorder." *Journal of Psychopharmacology*, vol. 14, Mar.

2000, https://doi.org/10.1177/02698811000142s102.

Davis, Alan K., et al. “Effects of Psilocybin-Assisted Therapy on Major Depressive Disorder: A Randomized Clinical Trial.” *JAMA Psychiatry*, vol. 78, no. 5, May 2021, p. 481. *DOI.org (Crossref)*, https://doi.org/10.1001/jamapsychiatry.2020.3285.

Erwin Krediet, et al. “Reviewing the Potential of Psychedelics for the Treatment of PTSD.” *The International Journal of Neuropsychopharmacology*, vol. 23, no. 6, June 2020, pp. 385–400, https://doi.org/10.1093/ijnp/pyaa018.

Garcia-Romeu, Albert, et al. “Psilocybin-Occasioned Mystical Experiences in the Treatment of Tobacco Addiction.” *Current Drug Abuse Reviews*, vol. 7, no. 3, 2014, pp. 157–64. *PubMed*, https://doi.org/10.2174/1874473708666150107121331.

Goldberg, Simon B., et al. “The Experimental Effects of Psilocybin on Symptoms of Anxiety and Depression: A Meta-Analysis.” *Psychiatry Research*, vol. 284, Feb. 2020, p. 112749. *PubMed*, https://doi.org/10.1016/j.psychres.2020.112749.

Griffiths, R. R., et al. “Psilocybin Can Occasion Mystical-Type Experiences Having Substantial and Sustained Personal Meaning and Spiritual Significance.” *Psychopharmacology*, vol. 187, no. 3, Aug. 2006, pp. 268–83; discussion 284-292. *PubMed*, https://doi.org/10.1007/s00213-006-0457-5.

Griffiths, Roland R, et al. “Psilocybin Produces Substantial and Sustained Decreases in Depression and Anxiety in Patients with Life-Threatening Cancer: A Randomized Double-Blind Trial.” *Journal of Psychopharmacology*, vol. 30, no. 12, Dec. 2016, pp. 1181–97. *DOI.org (Crossref)*, https://doi.org/10.1177/0269881116675513.

Grob, Charles S., et al. “Pilot Study of Psilocybin Treatment for Anxiety in Patients With Advanced-Stage Cancer.” *Archives of General Psychiatry*, vol. 68, no. 1, Jan. 2011, p. 71. *DOI.org (Crossref)*, https://doi.org/10.1001/archgenpsychiatry.2010.116.

Hall, Wayne. “Why Was Early Therapeutic Research on Psychedelic Drugs Abandoned?” *Psychological Medicine*, vol. 52, no. 1, Jan. 2022, pp. 26–31. *PubMed*, https://doi.org/10.1017/S0033291721004207.

Hoskins, Mathew, et al. “Pharmacotherapy for Post-Traumatic Stress Disorder: Systematic Review and Meta-Analysis.” *The British Journal of Psychiatry*, vol. 206, no. 2, Feb. 2015, pp. 93–100. *Cambridge University Press*, https://doi.org/10.1192/bjp.bp.114.148551.

Jacobs, Edward. *A Potential Role for Psilocybin in the Treatment of Obsessive-Compulsive Disorder*. July 2020. *akjournals.com*, https://doi.org/10.1556/2054.2020.00128.

Johns Hopkins Center for Psychedelic and Consciousness Research. 2000, https://www.hopkinsmedicine.org/psychiatry/research/psychedelics-research.

Johns Hopkins Medicine Receives First Federal Grant for Psychedelic Treatment Research in 50 Years. 2021, https://www.hopkinsmedicine.org/news/newsroom/news-releases/2021/10/johns-hopkins-medicine-receives-first-federal-grant-for-psychedelic-treatment-research-in-50-years.

Johnson, Matthew W., et al. “Pilot Study of the 5-HT $_{2A}$ R Agonist Psilocybin in the Treatment of Tobacco Addiction.” *Journal of Psychopharmacology*, vol. 28, no. 11, Nov. 2014, pp. 983–92. *DOI.org (Crossref)*, https://doi.org/10.1177/0269881114548296.

Karestan C. Koenen, et al. “Posttraumatic Stress Disorder in the World Mental Health Surveys.” *Psychological Medicine*, vol. 47, no. 13, Apr. 2017, pp. 2260–74, https://doi.org/10.1017/s0033291717000708.

Matthew W. Johnson, Matthew W. Johnson, William A. Richards, et al. “Human Hallucinogen Research: Guidelines for Safety.” *Journal of Psychopharmacology*, vol. 22, no. 6, May 2008, pp. 603–20, https://doi.org/10.1177/0269881108093587.

Matthew W. Johnson, Matthew W. Johnson, R. Andrew Sewell, et al. “Psilocybin Dose-Dependently Causes Delayed, Transient Headaches in Healthy Volunteers.” *Drug and Alcohol Dependence*, vol. 123, no. 1, June 2012, pp. 132–40, https://doi.org/10.1016/j.drugalcdep.2011.10.029.

McNulty, Helen Claire. *The Past, Present and Future of Psychedelics*. 2021. *Zotero*, https://egrove.olemiss.edu/hon_thesis/1931/.

Michael C. Mithoefer, et al. “Novel Psychopharmacological Therapies for Psychiatric Disorders: Psilocybin and MDMA.” *The Lancet Psychiatry*, vol. 3, no. 5, May 2016, pp. 481–88, https://doi.org/10.1016/s2215-0366(15)00576-3.

Mithoefer, Michael C., et al. “MDMA-Assisted Psychotherapy for Treatment of PTSD: Study Design and Rationale for Phase 3 Trials Based on Pooled Analysis of Six Phase 2 Randomized Controlled Trials.” *Psychopharmacology*, vol. 236, no. 9, Sept. 2019, pp. 2735–45. *Springer Link*, https://doi.org/10.1007/s00213-019-05249-5.

Moreno, Jonathan D. “Acid Brothers: Henry Beecher, Timothy Leary, and the Psychedelic of the Century.” *Perspectives in Biology and Medicine*, vol. 59, no. 1, 2016, pp. 107–21.

National Institutes of Health - an Overview | ScienceDirect Topics. June 2024, https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/national-institutes-of-health.

Nichols, David E. “The Heffter Research Institute: Past and Hopeful Future.” *Journal of Psychoactive Drugs*, vol. 46, no. 1, Jan. 2014, pp. 20–26. *DOI.org (Crossref)*, https://doi.org/10.1080/02791072.2014.873688.

Passie, Torsten, et al. “The Pharmacology of Psilocybin.” *Addiction Biology*, vol. 7, no. 4, Oct. 2002, pp. 357–64. *DOI.org (Crossref)*, https://doi.org/10.1080/1355621021000005937.

Rainer Kraehenmann, et al. “Psilocybin-Induced Decrease in Amygdala Reactivity Correlates with Enhanced Positive Mood in Healthy Volunteers.” *Biological Psychiatry*, vol. 78, no. 8, Oct. 2015, pp. 572–81, https://doi.org/10.1016/j.biopsych.2014.04.010.

Reardon, Sara. “MDMA Therapy for PTSD Rejected by FDA Panel.” *Nature*, June 2024, pp. d41586-024-01622–23. *DOI.org (Crossref)*, https://doi.org/10.1038/d41586-024-01622-3.

Reiff, Collin M., et al. “Psychedelics and Psychedelic-Assisted Psychotherapy.” *American Journal of Psychiatry*, vol. 177, no. 5, May 2020, pp. 391–410. *ajp.psychiatryonline.org (Atypon)*, https://doi.org/10.1176/appi.ajp.2019.19010035.

Ronald C. Kessler. “Posttraumatic Stress Disorder: The Burden to the Individual and to Society.” *The Journal of Clinical Psychiatry*, vol. 61, May 2000, pp. 4–12.

Rucker, James J. H., et al. “Psychiatry & the Psychedelic Drugs. Past, Present & Future.” *Neuropharmacology*, vol. 142, Nov. 2018, pp. 200–18. *ScienceDirect*, https://doi.org/10.1016/j.neuropharm.2017.12.040.

S. Woodburn, et al. “Psilocybin Facilitates Fear Extinction: Importance of Dose, Context, and Serotonin Receptors.” *bioRxiv*, 2024, https://doi.org/10.1101/2024.05.04.592469.

Steenkamp, Maria M., et al. “Psychotherapy for Military-Related PTSD: A Review of Randomized Clinical Trials.” *JAMA*, vol. 314, no. 5, Aug. 2015, pp. 489–500. *Silverchair*, https://doi.org/10.1001/jama.2015.8370.

Stephen Ross, et al. “Rapid and Sustained Symptom Reduction Following Psilocybin Treatment for Anxiety and Depression in Patients with Life-Threatening Cancer: A Randomized Controlled Trial.” *Journal of Psychopharmacology*, vol. 30, no. 12, Nov. 2016, pp. 1165–80, https://doi.org/10.1177/0269881116675512.

Strassman, R. J. “Human Psychopharmacology of N,N-Dimethyltryptamine.” *Behavioural Brain Research*, vol. 73, no. 1–2, 1996, pp. 121–24. *PubMed*, https://doi.org/10.1016/0166-4328(96)00081-2.

Strumila, Robertas, et al. “Psilocybin, a Naturally Occurring Indoleamine Compound, Could Be Useful to Prevent Suicidal Behaviors.” *Pharmaceuticals*, vol. 14, no. 12, Nov. 2021, p. 1213. *DOI.org (Crossref)*, https://doi.org/10.3390/ph14121213.

Thomas, Kelan, et al. “Psilocybin-Assisted Therapy: A Review of a Novel Treatment for Psychiatric Disorders.” *Journal of Psychoactive Drugs*, vol. 49, no. 5, 2017, pp. 446–55. *PubMed*, https://doi.org/10.1080/02791072.2017.1320734.

Tracey Varker, et al. “Efficacy of Psychoactive Drugs for the Treatment of Posttraumatic Stress Disorder: A Systematic Review of MDMA, Ketamine, LSD and Psilocybin.” *Journal of Psychoactive Drugs*, vol. 53, no. 1, 2020, pp. 85–95, https://doi.org/10.1080/02791072.2020.1817639.

Ulrich Schnyder, et al. “Psychotherapies for PTSD: What Do They Have in Common?” *European Journal of Psychotraumatology*, vol. 6, no. 1, Aug. 2015, pp. 28186–28186, https://doi.org/10.3402/ejpt.v6.28186.

Visual Capitalist, Sponsored. “The History of Psychedelics (Part 1 of 2).” *Visual Capitalist*, 12 Mar. 2021, https://www.visualcapitalist.com/sp/the-history-of-psychedelics-part-1-of-2/.

Wasson, R. Gordon. “Seeking the Magic Mushroom.” *Life*, vol. 42, no. 19, 1957, pp. 100–20.