A Systematic Review of Transcendent States Across Meditation and Contemplative Traditions

Helané Wahbeh, ND, MCR[1#] Amira Sagher, MSc[1] Wallis Back, MA[1] Pooja Pundhir, MD[1] and Frederick Travis, PhD[2]

Background: Across cultures and throughout history, transcendent states achieved through meditative practices have been reported. The practices to attain transcendent states vary from transcendental meditation to yoga to contemplative prayer, to other various forms of sitting meditation. While these transcendent states are ascribed many different terms, those who experience them describe a similar unitive, ineffable state of consciousness. Despite the common description, few studies have systematically examined transcendent states during meditation.

Objectives: The objectives of this systematic review were to: 1) characterize studies evaluating transcendent states associated with meditation in any tradition; 2) qualitatively describe physiological and phenomenological outcomes collected during transcendent states and; 3) evaluate the quality of these studies using the Quality Assessment Tool.

Methods: Medline, PsycINFO, CINAHL, AltHealthWatch, AMED, and the Institute of Noetic Science Meditation Library were searched for relevant papers in any language. Included studies required adult participants and the collection of outcomes before, during, or after a reported transcendent state associated with meditation.

Results: Twenty-five studies with a total of 672 combined participants were included in the final review. Participants were mostly male (61%; average age 39 ± 11 years) with 12.7 ± 6.6 (median 12.6; range 2–40) average years of meditation practice. A variety of meditation traditions were represented: (Buddhist; Christian; Mixed (practitioners from multiple traditions); Vedic: Transcendental Meditation and Yoga). The mean quality score was 67 ± 13 (100 highest score possible). Subjective phenomenology and the objective outcomes of electroencephalography (EEG), electrocardiography, electromyography, electrooculogram, event-related potentials, functional magnetic resonance imaging, magnetoencephalography, respiration, and skin conductance and response were measured. Transcendent states were most consistently associated with slowed breathing, respiratory suspension, reduced muscle activity and EEG alpha blocking with external stimuli, and increased EEG alpha power, EEG coherence, and functional neural connectivity. The transcendent state is described as being in a state of relaxed wakefulness in a phenomenologically different space-time. Heterogeneity between studies precluded any formal meta-analysis and thus, conclusions about outcomes are qualitative and preliminary.

Conclusions: Future research is warranted into transcendent states during meditation using more refined phenomenological tools and consistent methods and outcome evaluation.

Key words: transcendent states, meditation, contemplative traditions, psychophysiology

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INTRODUCTION

Transcendent states are ubiquitous within cultures and religions throughout human history. Spiritual practices such as meditation evoke experiences of heightened awareness and interconnectivity commonly associated with transcendence. Transcendence can be defined as an ineffable, qualitative experience of an altered state of consciousness. When transcendent experiences occur spontaneously, with or without practice or training, they are commonly referred to as a peak, religious, or mystical experience.[1] While ascribed different names such as Samadhi, nondual, pure consciousness, nondual awareness, and oneness, the state of transcendence is often similarly described across traditions.

Despite the various names, this state is often similarly described. In states of pure consciousness, there is little phenomenological content, and an absence of dualistic perception and sense of self.[2] Nondual states are characterized by pure awareness, free from fragmentation into dualistic thinking or experience, such as the sense of separateness between self and other.[3,4] Nonduality can be described as a background awareness, which precedes conceptualization and intention and that contextualizes various perceptual, affective, and cognitive contents outside of dualistic experience.[4] Nonduality is distinguished by a continuity of awareness, or beingness that prevails in the absence of fine bodily, emotional, or mental states.[5] During nondual states,

1 Institute of Noetic Sciences, Petaluma, CA
2 Maharishi Vedic Science Department, Maharishi University of Management, Fairfield, IA
Corresponding author: Helané Wahbeh, ND, MCR, Institute of Noetic Sciences, Petaluma, CA.
e-mail: hwahbeh@noetic.org.

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thoughts are experienced as emerging from, and submerging into, pure awareness, which underlies but is not involved with thought. In this way, the person remains a witness to thoughts, feelings, and perceptual experiences. Transcendence is observing them as they arise from a perspective removed from the normal conscious experience of the self-described as a blissful, superconscious state, in which one perceives the identity of the individualized soul and the Cosmic spirit.[6] Samadhi is the Sanskrit word for transcendence, originating from the words *sama*, meaning even, and *dhi* meaning intellect. Samadhi is loosely translated as mental equilibrium of a balanced and tranquil state of awareness. Thus, despite various nomenclature, different traditions have common descriptors for the transcendence state, namely a contentless-awareness that is absorptive, unitive, undifferentiated, and adaptive.

Transcendent states are challenging to study, given that they differ from the content of typical subjective experience. Transcendent states are experienced as a continuity of awareness despite the absence of sensory or cognitive perception. Further, transcendence differs from typical experiences that are characterized by content, such as outer objects, inner thoughts, emotions, sensations, and an experiencer's point of view. In transcendent states, the experience is brought to finer states of being whereby they are "left awake by itself in full awareness of itself without any experience of an object."[7,8] Therefore, it is difficult to assess when participants are experiencing transcendental states, since by definition they do not involve an individual experiencer who is able to evaluate or signal the onset of the experience. The lack of clear or consistent operational definitions for observed clinical benefits and the underlying mechanisms makes it challenging to study. Other challenges include the inability to discern differences in examined states because of between and within tradition heterogeneity.[9]

Despite these limitations, some research has been conducted on transcendent states. While many meditation practitioners consider transcendence a goal of their practice, very few experimental studies have systematically examined the transcendent state and its long-term effects. The largest body of research in this area has been completed by Travis at the Maharishi University of Management in the study of Transcendental Meditation.[5,8,10] Josipovic[4,11] has also conducted a review including neuroimaging research of nondual awareness. Metabolic parameters of the state have been reviewed,[12] case studies of advanced practitioners conducted,[13,14] factors facilitating or hindering the Samadhi state elucidated,[15] and questionnaires created to evaluate meditative depth and Samadhi characteristics.[16,17]

Although the research to date is encouraging, it is still limited given the number of meditation research papers that are now published (4448 on Pubmed 7/5/17). The paucity of research is surprising, considering transcendence's importance in numerous traditions. A cross-tradition synthesis of completed research is needed to advance the meditation science field. The present review attempts to fill the major gap in this research by collating available data from studies reporting transcendent states of consciousness associated with meditation, across various spiritual traditions.

The goal of this review is to report findings of transcendent states during meditation and their physiological correlates. First, we present a review of the transcendence concept in five major world spiritual traditions: Vedic, Buddhist, Christian, Judaic, and Islamic. We explore the different characteristics and names in the different traditions. We then present the methods and results of the systematic review. The objectives of the systematic review were to: (1) characterize studies evaluating transcendent states associated with meditation across traditions, (2) qualitatively describe physiological and phenomenological outcomes collected during transcendent states, and (3) evaluate the quality of these studies using the Quality Assessment Tool.[18,19]

REVIEW OF TRANSCENDENT STATES ACROSS TRADITIONS

Vedic Tradition

The Vedic approaches are a vast and extensive tradition with many variations and diversities in their application. This section does not attempt to cover the whole of the Vedic tradition but is just a brief overview highlighting those with current experimental research applied to them.

The Indian physician and mystic Patanjali (II BC) compiled the *Yoga Sutra,* one of Vedic's oldest meditation scriptures. This Sutra is a collection of 196 brief phrases describing the state of Yoga developed within meditation practice.[2] Patanjali defines "Yoga" in the Sanskrit sentence as *chitta vritti nirodha*, meaning "the complete settling of the activity of the mind."[20] Patanjali describes different states of Samadhi: *savitarka Samadhi*, (clear thought or concentration); *vichara Samadhi* (meditation/faint thought); and *nirbija Samadhi* (Samadhi, or thoughtless inner awareness/pure consciousness).[21] According to the Vedic tradition, Samadhi is described as taking "the form of gross mental activity, then subtle mental activity, then bliss and pure individuality."[2,22] Attaining Samadhi is to reach the silent state of pure consciousness where there is no phenomenological content and a loss of any sense of individual self or duality.[2,23,24] Achieving this pure consciousness can be regarded as the endpoint of the transcending process; an undirected consciousness, silent and awake within itself.[1]

Swami Vivekananda brought yoga to the West in the late 19th century. Maharishi Mahesh Yogi then brought Transcendental Meditation (TM) from India to Western culture and rapidly spread awareness and knowledge of this ancient consciousness practice in the late 1950s. TM is said to allow the individual to transcend through a process of appreciating mantras at finer levels. The mantra becomes increasingly secondary in experience, ultimately disappearing and allowing self-awareness to become the primary consciousness.[5,22,25] Maharishi Mahesh Yogi describes transcending as turning one's attention inwards toward subtler levels of thought, until the mind transcends the experience of the subtlest state and becomes completely still, at rest, yet fully awake and called this transcended state "pure consciousness" or "transcendence."[22] In this description of transcendence, there is no customary content of experience such as thoughts, feelings or perceptions, but instead a self-referral consciousness. Self-referral consciousness is conscious of itself alone, whereby the mind is identified with the greater creative intelligence, or

Being, which gives rise to thought.[22,26] Interestingly, Maharishi Mahesh Yogi also described pure consciousness as the unified field of consciousness, analogous to the unified field of matter, which is at the heart of super-symmetric unified quantum field theories (e.g., superstring theory).[26,27] While showing superficial similarities, there is an important distinction between the unified of field of natural law (as described by physics) and the experience of pure consciousness (the state of Samadhi). These differences could be analogized as the "map" and the "territory," respectively. Physics provides a map of the self-interaction of a single unified field to generate known forces and particles, while meditation traditions facilitate the felt experience of that field. Despite these differences, the laws of physics could possibly benefit from further examination of transcendent states.

Modern science has probed into the underlying physiological characteristics of the Vedic experience of Samadhi, particularly as it is described and experienced among those who have practiced the TM technique. Wallace[28] reported a physiological state of functioning specific to TM practice including reduced oxygen consumption, decreased heart rate, increased basal skin resistance, while at the same time exhibiting a higher density and amplitude of alpha brain waves.[26] The experience of pure consciousness during TM has been described as "silence" and the "loss of boundaries of time, space, and body sense that defines the framework for typical waking experience."[25] This lends support to the description of Transcendental Consciousness as a fourth major state of consciousness that is not an altered state of waking, but a state of distinct physiological and subjective characteristics (discussed in Ref. 5).

Buddhist Tradition

The oldest mention of transcendent states in Buddhism was found in the sacred Chandogya Upanishad text. Teachings of *sunyata* (the two truths doctrine) of the nonduality of the absolute and relative truth, and *yogachara* notion of pure consciousness or immaculate consciousness that is identified with the nature of reality, are integral to Buddhist philosophy. Chinese Buddhism refers to nonduality as *advaya*, the conventional and ultimate truth. In Tibetan Buddhism, nondual awareness describes the background awareness that precedes conceptualization and intention. Nonduality contextualizes the content of perceptions, emotions, and cognitions as a unified experience, free of any fragmentation into the dualistic realms of "this or that" or "then and now." The state can be characterized by its reflexive nature, knowing itself to be conscious without relying on conceptual cognition.[4] In Zen Buddhism, nonduality or nondual awareness, are states of Samadhi that can lead to enlightenment.[1,29] In contrast to the transient nature of fleeting transcendent states, enlightenment describes a more permanent integration of the truths experienced during transcendence.

The Buddhist term translated into English as mindfulness, originates in the Pali term *sati*. With the rise of modern mindfulness-based interventions, the meaning of mindfulness has been extensively debated. The term *sati* means "to remember" or "remember the *dharma*" whereby the true nature of phenomena can be seen.[30] The Buddhist word Vipassana practice means to see how things actually are, rather than how they seem to be is. Through the Vipassana practice, a person may experience a meta-awareness watching the mindfulness process, that is, they transcend and experience Samadhi. Thus, mindfulness in its traditional usage signified the simultaneous presence of Samadhi, pure consciousness, or being, along with ongoing perceptual processing and can be considered is another state of consciousness. The practice of mindfulness is woven throughout early Buddhist traditions, such as Theravada and Zen, and it is common across all schools of Buddhism.

Mindfulness, especially as it is currently understood especially in secular applications of mindfulness is as a cognitive act—dispassionate observation. It is the practice of focusing attention on the body, breath, and content of any thought[2] and observing one's own cognitive and affective processes.[4] Mindfulness meditation can be focused-attention meditation (voluntary and sustained attention on a chosen object), or open-monitoring meditation (nonreactive monitoring of the moment-to-moment content of experience).[9,31] The emphasis on the object-only approach in focused-attention meditation is to focus on the momentary nature of sensory experience and no focus on the subjective side of experience and self-related mental processes. Evidence for the clinical benefits of secular mindfulness-based interventions is growing rapidly.[32,33]

Christian Traditions

Although less frequently researched, evidence of transcendent states is present within the historical texts and customs of the Christian tradition. Bernard McGinn defines Christian mysticism as "[T]hat part, or element, of Christian belief and practice that concerns the preparation for, the consciousness, and effect, of […] "a direct and transformative presence of God."[34] Religious ecstasy is considered to be an altered state of consciousness characterized by reduced external awareness and expanded mental and spiritual awareness. Religious ecstasy is frequently accompanied by visions, and by emotional, sometimes physical, and euphoria. Although the experience is often transient, there are records of these states lasting several days or more, and of recurring experiences throughout a person's lifetime.

Mysticism is a term used to describe communion with an ultimate reality. Mysticism can also be defined as unique and sacred experiences of God, expressing an ontological conformity between the mystic (the person who believes), and the divine (God). This sacred mode of perception can arise spontaneously or by following a path steeped in prayer.[35] A mystical experience is a trans-sensory metamorphosis of consciousness resulting in a transformation from sensory to beyond sensory experience.[35] According to the Christian Contemplative Tradition, once a person's whole being, including their mind and heart, is open to God, then a relationship is initiated by God. With the person's consent, this relationship leads to divine union. A form of contemplative prayer was first practiced and taught by the Desert Fathers of Egypt, Palestine, and Syria. These include Evagrius, St. Augustine, and St. Gregory the Great in the West, and Pseudo-Dionysius and the Hesychasts in the

East.[36] Mystical Contemplative Prayer is the experience of unity with God and is something that cannot be attained by human effort, emerging naturally as the divine reception of God's presence. Mystical Contemplative Prayer has three characteristics: (1) it is infused (i.e., implanted by God in the soul and not the result of human effort); (2) it is extraordinary (i.e., indicating that the intellect operates in new way); and (3) it is passive (i.e., showing that the soul receives something from God, and is conscious of receiving it). This form of Contemplative Prayer manifests itself in one of four degrees: (1) the prayer of quiet, (2) the prayer of union, (3) ecstatic union, and (4) transforming deifying union. The Christian tradition has identified characteristics of these states as a person's sense of time and space disappearing during religious ecstasy. During these experiences, a person releases attachments to the traditional senses and cognizing of the world. Venerated Catholic saints who have made use of Christian mysticism have described how a person's physical stature, sensory, or perceptual state is absent from contexts of time and space during ecstatic experiences.

Judaic Tradition

The Kabbalah contains the Jewish mystical teachings and is used to connect with the Light of the Creator for spiritual transformation.[37] Jewish spiritual practices include *tefillah* (prayer) and *talmud torah* (learning of a wide range of traditional texts) with a special emphasis on mystically oriented knowledge. The Kabbalah also refers to the ineffable experience of transcendence. "The true essence of G-d is so transcendent that it cannot be described, except with reference to what it is not. This true essence of G-d is known as Ein Sof, which literally means "without end," which encompasses the idea of His lack of boundaries in both time and space. In this truest form, the Ein Sof is so transcendent that It cannot have any direct interaction with the universe. The Ein Sof interacts with the universe through ten emanations from this essence, known as the Ten Sefirot."[38]

Islamic Tradition

Sufism is the spiritual dimension of Islam which emerged in the late sixth century.[39] The word *Islam* came to be identified with a religious organizational system originating from the mystical-spiritual path delivered by the Prophet Muhammad.[40] There are a number of important figures in the Islamic tradition who describe transcendent experiences. Author and poet Nāṣir-i Khusraw offers advice on the catharsis of the soul and the pursuing of the spiritual journey. He says that "the science of the soul is the way to attain real knowledge, knowledge which transcends the difference between the perceiver and perception." Other Sufi masters such as Hallāj (858–922 CE), Rūmī (1207–1273 CE), and Ḥāfiz (1320–1388 CE) among others, provide the reader with an understanding of how the love of God can lead to the transcendental unity of being. Mullā Ṣadrā, a prominent metaphysician of the Islamic philosophical tradition, created a grand synthesis of discursive philosophy, intellectual intuition, and asceticism that came to be known as the "Transcendental Theo-Sophy" (*al-ḥikmat al-muta'āliyah*).[41]

Other Paths to Transcendence

In addition to exploring these states in religious and spiritual traditions, similar descriptions of a transcendent state have been ascribed in modern Western culture, specifically identified through spontaneously arising transcendent experiences,[42] other spiritual practices, drug-induced and psychedelic substances use[43] as well as arising within psychopathology.[44,45] As succinctly described by Charles Tart in his book Altered States of Consciousness, "The relatively new ASCs [altered states of consciousness] that are now having such an effect are those produced by marijuana, more powerful psychedelic drugs such as LSD, meditative states so-called possession states and autohypnotic states …. The youth of today and mature scientists in increasing numbers are turning to meditation, oriental religions, and personal use of psychedelic drugs. The phenomena encountered in these ASCs provide more satisfaction and are more relevant to the formation of philosophies of life and deciding upon appropriate ways of living, than pure reason."[46]

Although these traditions (and others) incorporate different experiences to manifest the state, each contains descriptions and language associated with transcendent states of consciousness. Future cross-cultural research into this area would benefit the field beyond this very brief review. We conducted a systematic review of the literature in order to evaluate studies on the transcendent state associated with meditation beyond philosophical or phenomenological descriptions.

METHOD

Protocol and Registration

Methods of the analysis and inclusion criteria were specified in advance and documented in a protocol with the Joanna Briggs Institute as recommended.[47]

Literature Search Methods

Studies were identified by scanning reference lists, the Institute of Noetic Science Meditation Library and searching the following electronic databases: MEDLINE (1950—08/03/2016), PsycINFO (1967—08/03/2016), CINAHL (1982—08/03/2016), Alt HealthWatch (1984—08/03/2016), AMED (1980—08/03/2016). Searching was an iterative process as new references were found. The search strategy was developed and carried out by HW. Search terms included Samadhi, transcendence, transcendent, conscious awareness, thoughtless awareness, *samāpatti*, nondualistic, charisma, religious ecstasy, yoga, cognitive cessation, cessation-contemplation, fixed mind, one-pointed attention, concentration meditation, *Jhana*, bliss, ananda, emptiness, nonperception, formless perception, egolessness, nothingness, *Dhyana*, ecstasy, mystical union, meditative insight, no thought, ecstatic consciousness, enstasis, wisdom meditation, self-realization, meditative absorption, union of love, and mystical knowledge. There were no restrictions on language. Articles in French were translated by one of the researchers. The search strategy from OVID Medline is included as supplemental information (Appendix).

Study Eligibility

To ensure that studies were selected in a systematic and unbiased way, specific eligibility criteria were used to select articles included in the review. To increase objectivity and decrease the risk of mistakes in study selection, two reviewers independently screened titles and abstracts of all publications retrieved by the search terms according to the eligibility criteria listed below (HW, JB). Disagreements were resolved by consensus. No third party was needed to arbitrate. Authors were not contacted to confirm or contribute complete missing data. The level of inter-rater agreement was high, although not formally assessed. The search strategy was reviewed by HW and FT. Studies meeting the following inclusion criteria were selected for further review.

Study design. The studies needed to be peer-reviewed. All study designs were considered, including published randomized trials, cross-cultural research and longitudinal studies exploring the physiological, neurological and subjective contexts of transcendent states. These included studies published in different languages. Only studies which measured participants during or immediately following a transcendent state were included. Studies which did not explicitly report that participants were in a transcendent state were excluded. Each study included at least one objective or subjective outcome measure. Studies that were included reported a wide range of outcome measures with the expectation that such studies would demonstrate a reduced risk of reporting bias.

Types of Participants. Adult participants practicing different types of meditation (including Yoga, Contemplative Prayer, Sitting Meditation, etc.) and novices/nonpractitioners were included. Comparator group participants included nonmeditators and meditators of varying experience levels.

Interventions. A transcendent state associated with meditation.

Types of Comparators. Studies with any comparator were included. Examples are nonmeditating controls and comparisons between groups with different levels of meditative experience.

Outcome Measures. Any study that assessed subjective or objective measures before, during, or after a reported transcendent state was included. Primary outcome measures included physiological, neurological, and phenomenological data.

Data Extraction and Management

The reviewers developed a data extraction Google Sheet in which the following data were collected: author, year, study design, number of subjects, inclusion and exclusion criteria, age, years of meditation practice, meditation type studies, outcomes measured, results for each measure, how Samadhi state was assessed, position during meditation, how researchers define transcendent state, if achieving it was spontaneous or systematic, and adverse events. "NR" was included in the field for any items that were not reported. A single reviewer extracted the data and another independent reviewer verified the accuracy and completeness of the data extraction. Any discrepancies were resolved by consensus. All study data were managed using Microsoft Excel and an Access relational database (Microsoft Corporation, Redmond, Washington).

Risk of Bias in Individual Studies

Because not all studies assessed were randomized controlled trials (RCT), the gold-standard risk of bias tool used specifically for RCTs, the Cochrane Risk of Bias Tool, was not appropriate for this review.[18] Instead, the Quality Assessment Tool (QAT) was used to evaluate each study for methodological quality and bias. The QAT was modeled after the *Aid to the Evaluation of Therapeutic Studies* developed by Reisch et al.[19] and modified as recommended by Deeks.[18,48] It grades study quality and risk of bias on important constructs, including: blinding, randomization, adequate reporting, attrition, sample size, determination, and control group usage. A quantitative score is calculated, which is adjusted for study design by removing questions about randomization, comparisons between groups, and blinding for non-RCT and uncontrolled trials. The result is an adjusted score on a scale of 0–100, 100 being the highest quality study. Two authors assessed the methodological quality independently. A third author resolved any disagreements through consensus. Risk of bias across studies was not evaluated since we did not conduct a meta-analysis.

Planned Methods of Analysis

Data were synthesized and reported qualitatively according to relevant categories such as outcomes and traditions. We anticipated that a meta-analysis would not be possible because of study heterogeneity and therefore sought to provide a general understanding of the available evidence.

RESULTS

The search terms were purposefully kept broad to spread a wide-net for relevant papers. A total of 491 studies were identified for review (Figure 1). After removing duplicates, 457 titles and abstracts were screened for inclusion criteria. Studies were excluded on the abstract level because the study did not match the inclusion and exclusion criteria. Most of these studies were review or commentary articles that mentioned one of the search terms. Sixty-one potentially relevant full-text articles were assessed for eligibility. Reasons for exclusion of articles at this point are presented in Figure 1. Of these, 25 studies with a total of 672 combined participants were included in the final review (included studies are listed before the references).

Description of Included Studies

Included studies and relevant parameters are listed in Table 1. The studies were published between 1955 and 2015, with 16 published after 2000. All studies had a cross-sectional study design. One study was in French,[49] one in Japanese with an English abstract,[50] and the rest were in English. Two of the studies asked participants general qualitative questions during

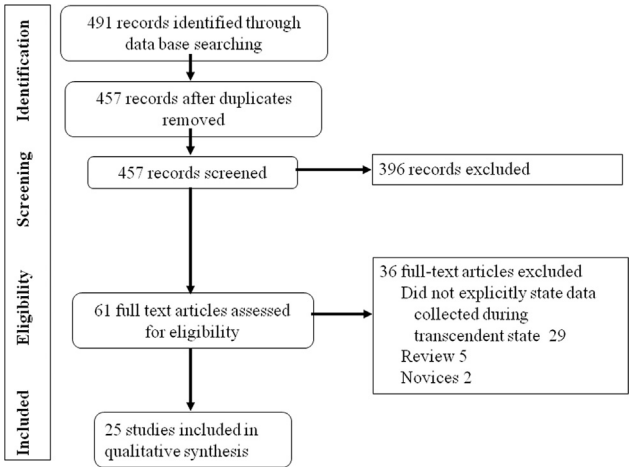

Figure 1. Flow diagram of study selection. The numbers of studies at each step of the selection process.

or immediately after a transcendent state. Twenty-two studies examined meditators in a laboratory undergoing different conditions (e.g., meditation versus nonmeditation) and conducted within-subject analyses. Four studies had a control group (e.g., nonmeditators and between-subject analyses) in addition to collecting data in different conditions. Nine studies reported meditators in a seated position during data collection and in one of those studies the researchers gave the meditator a choice of sitting in a chair or on the floor in half or full lotus position. Fifteen studies did not report the position of the meditator during the recordings (four of which were fMRI studies and infer the participants were lying down in the scanner). All included studies directly assessed participants during or immediately following the transcendent state.

Participants

The total number of participants was 672. The average number of subjects in each study was 28 ± 29 (range: 1–115). One study did not report exact participant number. Eighteen studies reported participant gender balance with an average of 39% participants being female. Of the studies that reported mean ages (76%), the total mean age for participants was 39 ± 11 years. Three studies did not report inclusion/exclusion criteria. Eleven required some level of meditation expertise (although the level varied), and 14 had a health criteria, such as no head injury or trauma, generally healthy, no mental illness. Three required no drug or medication use. Average years of meditation practice was 12.7 ± 6.6 (median = 12.6; range: 2–40). A variety of participant meditation types were represented: seven—Buddhist (Jhana, Theravada, Vipassana, Tibetan, Zen); two—Christian; three—Mixed (i.e., practitioners from multiple traditions); seven—Vedic: TM; six—Vedic: Yoga (Ananda Marga, Raj, Sahaj, Kriya, Sudarshan Kriya).

Assessing the Transcendent State

Ten studies had an experimental design that allowed the participant to trigger a signal when the transcendent state was reached. Fifteen of the studies evaluated if participants were in a transcendent state through self-report during or after the meditation. One study also evaluated frequency of transcendent experiences in addition to a lab trigger.[8]

Quality and Risk of Bias Within Studies

Methodological quality and bias for all studies as determined by the QAT is presented in Table 1. The mean score was mean 67 ± 13 (median = 71, range: 43–90). Several criteria were met by the majority of studies (at least 21 of 25): the statement of purpose of the study was given, the outcome variables defined prior to study, data collected prospectively under specified conditions and planned *a priori*, subjects selected prior to measurement and evaluated prospectively, the total number of subjects specified; subjects selected for the study were suitable for questions posed by researchers, protocol was adequately described, measures reasonable and appropriate to answer questions posed by researchers, compliance/adherence assessed, and evaluation methods (outcomes) adequately described. One study reported adverse events. Classic risk of bias parameters were not applicable, such as selection bias, since many of the studies were not RCTs; performance bias, since meditation cannot be blinded; and detection and attrition bias since the studies were not interventional. Reporting bias was not systematic evaluated.

Outcomes

The outcomes assessed were quite varied even within the same measure. For example, 13 studies conducted EEG spectral power analysis but design differences such as number of channel, location of channel, meditation condition, and control condition precluded meta-analysis or statistical synthesis. The following outcomes were measured in the included studies: ECG—ECG general one; heart rate three; heart rate variability one; HR deceleration one; respiratory sinus arrhythmia one; EEG—alpha blocking three; coherence three; peak frequency one; power and coherence at peak frequency one; sLoreta one; spectral analysis power 13; EMG two; EOG two; ERP—contingent negative variation one; mismatch negativity one; fMRI four; MEG two; respiration—breath rate three; respiratory suspension three; skin—GSR one; SCL one; SCR two.

ECG

Four unique studies collected ECG data and reported on various ECG measures. Badawi reported significant heart rate differences between baseline (71.4 bpm), during (67.2 bpm), and following (69.9 bpm) a transcendent state.[52] Travis evaluated ECG measures during transcendent and other experiences during meditation and found significant differences in respiratory sinus arrhythmia but no significant differences in heart rate and heart rate variability.[8] In another study, no difference in heart rate was found during a simple and choice reaction time task between meditators with three levels of transcendent experience, rare, occasional and continuous.[69] In a third study, Travis found a significant increase in heart rate deceleration during transcending

Table 1. Summary of Included Studies

Study	Year	*N*	Age	Meditation Experience (y)	Meditation Experience (Range)	Meditation Category	Design	Outcome	Samadhi Detection Method	QAT
Anand[13]	1960	4	NR	NR	NR	Christian	Within	EEG power, alpha blocking	Self-report	0.48
Ataria[51]	2015	1	45.2 ± 11.3	40	NR	Buddhist	Qualitative	3 stages of Sense of Boundaries	Self-report	0.71
Badawi[52]	1984	115	TM—26.3; non-TM 24.6; TM holding breath 24.8	TM—6.41; TM holding breath—4.65	TM—1.3–12; TM holding breath .08–9.41	Vedic: TM	Within; Between	EEG power, coherence; HR, Respiratory suspension, GSR	Lab signal	0.71
Baijal[53]	2010	20	37.5 ± 5	NR	3–7	Vedic: Yoga	Within; Between	EEG power	Self-report	0.67
Banquet[54]	1973	12	30	2	0.75–5	Vedic: TM	Within	EEG power, alpha blocking; EMG, EOG, Respiration	Lab signal	0.76
Beauregard[55]	2006	15	49.93 ± 11.27	19.27 ± 11.49	2–37	Christian	Within	fMRI	Self-report	0.57
Beauregard[56]	2008	14	49.93 ± 11.7	18.93 ± 11.85	2–37	Christian	Within	EEG power, coherence	Self-report	0.71
Berkovich-Ohana[57]	2013	11	44.9 ± 10.9	16.5 ± 7.9	9–34	Buddhist	Within	MEG	Self-report	0.76
Berman[3]	2015	44	43.98 ± 13.68	12.64 ± 10.66	NR	Mixed	Within	EEG power	Lab signal	0.76
Brown[58]	1980	13	NR	NR	1.5–25	Buddhist	Qualitative	Rorschach	Self-report	0.71
Das[49]	1955	8	NR	NR	2–15	Vedic: Yoga	Within	EEG power, ECG, EMG	Self-report	0.43
Dor-Ziderman[59]	2013	12	45.2 ± 11.3	16.5 ± 7.9	9–34	Buddhist	Within	MEG	Self-report	0.48
Farrow[60]	1982	95	29	8.85	0.1–16	Vedic: TM	Within	Respiratory Suspension	Lab signal	0.81
Hagerty[61]	2013	1	53	17	NR	Buddhist	Within	EEG power, fMRI	Lab signal	0.67
Hernández[62]	2015	19	46.6 ± 9.5	11.8 ± 7.4	3–24	Vedic: Yoga	Within	fMRI	Self-report	0.67
Hinterberger[63]	2014	30	47	20	0–21,185 h	Mixed	Within; Between	EEG power	Self-report	0.81
Josipovich[4]	2013	NR	NR	NR	4,000–37,000 h	Buddhist	Within	fMRI	Self-report	0.76
Lehmann[64]	2012	71	41.44 ± 2.22	11.3	6–17	Mixed	Within	EEG sLoreta	Self-report	0.57
Lo[65]	2003	38	44	15.5	11–20	Buddhist	Within	EEG alpha blocking	Lab signal	0.9
Srinivasan[66]	2007	20	37.5 ± 5.5	NR	3–7	Vedic: Yoga	Within; Between	ERP - MMN	Lab signal	0.48
Taneli[67]	1987	12	NR	3.4	0.45–9	Vedic: TM	Within	EEG power	Lab signal	0.81
Travis[68]	1997	24	Exp 1—35 ± 10.5; Exp 2—20.5 ± 2.2	Exp 1—12.6 ± 9.0; Exp 2—6.1 ± 3.5	Exp 1—0.4–22.5; Exp 2—3.3–9.3	Vedic: TM	Within	EEG power, HR, Respiration, SCR	Lab signal	0.67
Travis[8]	2001	30	22.5 ± 2.28	5.4 ± 0.067	NR	Vedic: TM	Within	EEG power, coherence, peak frequency; HR, HRV, RSA, respiration, SCL, SCR	Lab signal; Self-report	0.67
Travis[69]	2002	51	NR	Rare—0; occas—7.8 ± 3.0; cont—24.5 ± 1.2	0–24.5	Vedic: TM	Between	EEG power, coherence, CNV, HR	Self-report	0.71
Yamazaki[50]	1987	12	NR	NR	NR	Vedic: Yoga	Within	EEG power	Self report	0.48

Note: Within—expert meditators were assessed under different conditions (e.g., meditating vs. not meditating); between—expert meditators were compared to controls of varying experience; CNV, contingent negative variation; EEG, encephalography; ERP, event related potential; GSR, galvanic skin response; HF, high frequency; HR, heart rate; LF, low frequency; MMN, mismatch negativity; RSA, respiratory sinus arrhythmia; SCL, skin conductance level; SCR, skin conductance response.

experiences with respiratory suspension episodes, compared to other experiences during meditation.[68]

EEG

Alpha Blocking. Two studies examined alpha blocking during transcendent states using the following paradigm. Participants were instructed to go into a transcendent state and then, a stimulus that normally creates alpha blocking was introduced. Both studies did not observe the normal alpha blocking to the external stimulus when the participants were in the transcendent state.[13,54] One study observed alpha blocking when perceiving a light or receiving a blessing.[65]

Coherence. Five studies evaluated coherence with EEG. Lehmann examined intracortical functional connectivity using EEG standardized low-resolution brain electromagnetic tomography (sLORETA) with 32 EEG channels in 71 meditators from five traditions (Tibetan Buddhist, QiGong, Sahaja Yoga, Ananda Marga, and Zen) comparing meditation to rest.[64] They found lower coherence during meditation in all five traditions and frequency bands. Conventional coherence between the original head surface EEG time series also showed reduced coherence during meditation. Badawi examined TM meditators versus controls, whereby meditators were instructed to press a button after each experience of transcendental or pure consciousness.[52] Results from their previous research correlated respiratory suspension with pure consciousness. EEG coherence measured during respiratory suspension was significantly increased compared to nonrespiratory suspension periods and also compared to controls holding their breath. Beauregard evaluated coherence in 14 Carmelite nuns during a reliving of "the most intense mystical experience ever felt in their lives" and found increased coherence in theta (FP1–C3), alpha (F4–P4, F4–T6, F8–T6, C4–P4, and T5–O1), and beta (FP1–FP2).[56] Travis examined 51 TM practitioners grouped into rare, occasional, or continuous transcendental experience (TE) categories, reporting consistent coherence differences across these groups (observed in F3–F4 across all frequency bands).[69] The Rare-TE participants had significantly lower coherence than the occasional- and continuous-TE participants. There was no difference between occasional-TE and continuous-TE subjects during meditation despite wide variation in years practiced and self-reported experiences of transcendent states. Finally, Taneli and Krahne[67] qualitatively reported increased synchrony in frontal regions, most significantly in alpha, followed by theta, beta1, beta, and a smaller increase in delta power.

Peak Frequency. Travis compared the EEG peak frequency (frequency, power, and coherence) during transcendence states, with those occurring during other states of meditation and found that the peak frequency did not differ between the two states (transcending experience = 9.3 ± .27 versus other experience = 9.5 ± .28).[8] However, the peak frequency (namely, alpha) amplitude and coherence was significantly higher at frontal, central, and parietal electrode locations during transcendence.

Power. There were 13 studies that measured EEG power/amplitude frequency bands. The variation in the number of channels used, frequency band definitions, and channel locations precludes meta-analysis. A summary of study findings are presented in Table 2.

EEG Power Qualitatively Described. Two early studies qualitatively described EEG changes during deep meditation. In the oldest study found for this review, Das reported "EEG shows progress and very spectacular modifications during the deepest meditations. Acceleration of the alpha rhythm, a beta rhythm in rolandic areas, and generalized fast activity of small amplitude which may reach 25–30 c/s and sometimes even 40–45 c/s. During the Samadhi period, the generalized fast rhythms may be of higher amplitude, reaching 30 and 50 mV."[49] In the Banquet study, EEG power changes are described, "In four of the meditators a third stage occurred, signaled with the push-button as being deep meditation or even transcendence. It was characterized by a pattern of generalized fast frequencies with a dominant beta rhythm."[54] Two other papers describe changes in EEG with no values reported. Taneli and Krahne[67] reports that during a TM mantra stage, alpha, theta, and beta1 are increased. During a thinking stage, power drops significantly in all regions and there is a significant spectral broadening of alpha. The study reported that the effects of meditation are most distinctly visible in alpha EEG with high amplitude in occipital regions and low amplitude in frontal regions. Yamazaki conducted two experiments; the first distinguished differences in topographical features between the experimental and control group; the second classified EEG topographic patterns into three groups depending on the dominant area of slow wave (6–9 Hz), in frontal, centro-parietal, and occipital regions.[50] Interestingly, self-reported depth of meditation was correlated with EEG topographic patterns.

Transcendent states during meditation practices versus other meditation states. Six studies evaluated a transcendent meditation state versus other meditation states. Anand et al.[13] reported increased alpha amplitude during Samadhi, compared with earlier meditative states. Travis and Wallace[68] compared transcendent states with *inward stroke* consciousness during meditation, and reported decreases in theta and increases in alpha during transcendence. Badawi et al.[52] compared respiratory suspension episodes during meditation with general meditative states and found theta amplitude decreases with no changes in other frequencies. Berman and Stevens reported increases in delta, theta, and alpha during a transcendent state, and increased beta and gamma during the general meditation session when compared to each other.[3] Interestingly, when researchers evaluated the data during and immediately following the transcendent state, there was no difference in frequency bands. Hinterberger et al.[63] compared thoughtless emptiness to other meditative states and found no significant differences in EEG power. Finally, Beauregard and Paquette[56] found greater theta and gamma power during experiences of divine union with God, compared with experiences of unity with another person.

Table 2. Summary Table of Studies That Examined EEG Power

Author	Year	Channels	Delta	Theta	Alpha	Beta	Gamma
Qualitative description							
Banquet[54]	1973	8	NS	NS	NS	Increase	NS
Das[49]	1955	NR	NS	NS	Increase	NS	Increase
Taneli[67]	1987	12	NS	Increase	Increase	Increase	NS
Yamazaki[50]	1987	NR	NS	Increase	NS	NS	NS
Transcendent meditation vs. other meditation							
Anand[14]	1960	8	NR	NR	Increase	NR	NR
Badawi[52]	1984	16	NS	Decrease	NS	NS	NS
Beauregard[56]	2008	19	NS	Increase	NS	Increase	Increase
Berman[3]	2015	24	Increase	Increase	Increase	NS	NS
Travis[68]	1997	18	NS	Decrease	Increase	NS	NS
Transcendent meditation vs. rest							
Hinterberger[63]	2014	64	Decrease	Decrease	NS	Decrease	NS
Lehmann[64]	2012	32	NS	NS	Decrease	Increase	Increase
Transcendent meditators vs. controls							
Baijal[53]	2010	64	NS	Increase	NS	NR	NS
Travis[69]	2002	9	NS	NS	NS	NS	NS

Note: Qualitative—results were described but no values were reported; NS—reported and not significant; NR—not reported.

Transcendence During Meditation Vs Rest. Two studies evaluated EEG during transcendent states and rest conditions. Hinterberger et al.[63] found reduced delta, theta, and beta power in thoughtless emptiness compared to rest and Lehmann et al.[64] reported decreased alpha, and increased beta and gamma during Samadhi compared to rest.

Transcendence in Meditators Vs Controls. Travis et al.[69] studied three groups of meditators with different levels of transcendent experience (rare, occasional, and continuous) and found significant differences in EEG amplitude in the continuous meditation group, but not in practitioners who reported less frequent transcendent experience. Baijal and Srinivasan[53] evaluated meditators in Samadhi during meditation compared to nonmeditators and found increases in theta.

EMG/EOG

Two older papers measured transcendent states using electromyography (EMG) signals.[49,54] Both reported a reduction of EMG during deep meditation and immobility during general meditation. Banquet also qualitatively examined the electrooculogram and observed rapid eye movements at the beginning of meditation that shifted to slow eye movements and then no eye movement in deep meditation.

ERP

Two studies evaluated event related potentials. Travis et al.[69] reported on an event related potential called contingent negative variation (CNV) in 51 participants who had rare or continuous transcendental experiences. The CNV was lowest in the rare-TE group and highest in the continuous-TE group at frontal, central and parietal midline electrodes. Srinivasan and Baijal[66] examined mismatch negativity and found that meditators had significantly larger grand averaged mismatch negativity peak amplitudes immediately after meditation, compared to nonmeditators.

fMRI

Four studies examined neuroimaging during transcendent states using functional magnetic resonance imaging (fMRI). Beauregard and Paquette[56] collected fMRI on the same Carmelite nuns who participated in their later EEG study during a reliving of the most intense mystical experience ever felt in their lives.[55] Significant differences in Brodman Area (BA) 7, 10, 11, 13, 18, 19, 21, 32, 40 were reported compared to a rest condition and BA 7, 10, 11, 21, 32, 40 compared to unitive experiences with another person (rather than God). Hernandez examined 19 Sahaja yoga meditators entering into a state of mental silence. Comparing the best meditation session in the scanner, with the control condition (focusing attention on breath and belly breathing movements), there were no significant changes in multiple regions of the brain (BA 9, 10, 13, 21, 22, 32, 37, 39, 40, 44–47).[62] Finally, one case study of ecstatic meditation found significant differences in *a priori* regions of interest during "ecstatic joy experienced" associated with nucleus accumbens, medial orbitofrontal cortex, "altered sense of personal boundaries" associated with BA 5, 7, and "external awareness dims" associated with BA 17, 19, 41, 42, compared to rest and compared to the concentration condition.[61] Josipivoc[4] examined anticorrelation between intrinsic and extrinsic networks in

three meditation types: focused attention, fixation, and nondual awareness. Josipovic found that nondual awareness decreased the anticorrelation between intrinsic and extrinsic networks compared to rest. In other words, its effect increased functional connectivity between the two networks. In contrast, focused attention resulted in the opposite effect, significantly increasing the anticorrelation between the two networks. Beauregard and Hernandez shared significant differences in BA 10, 13, 21, 32, and 40. Beauregard and Hegarty shared significant differences in BA 7 and 19.

MEG

Two studies measured outcomes using magnetoencephalography. Berkovich-Ohana et al.[57] analyzed MEG in different phenomenological states during: here, now, spacelessness, and timelessness meditation conditions. There were no significant differences between "Here" and "Now" conditions in any of the four frequency bands tested. "Timelessness" and "Spacelessness" conditions overlapped at the posterior part of the right temporal gyrus, left cerebellum, bilateral posterior cingulate cortex, and adjacent precuneus. Berkovich-Ohana also examined 12 long-term mindfulness meditators to determine the mechanisms of self-awareness, narrative self-awareness, minimal self-awareness, and selfless, using MEG recordings and first-person descriptions.[59] Narrative self-awareness attention was characterized by decreases in high gamma (60–80 Hz), which was predominant in the left hemisphere and in frontal, thalamic, and extensive dorsal and ventral medial prefrontal cortex regions. *Minimal self-awareness* attention was characterized by decreases in beta (13–25 Hz) in both overlapping regions including the left ventral prefrontal cortex and thalamus, and right pre-motor region, as well as nonoverlapping regions including the right posterior cingulate cortex and precuneus medially, and bilateral right-hemisphere dominated inferior parietal lobule. Finally, *selfless experience* was associated with attention of beta activity in the right inferior parietal lobule.

Respiration

Three articles reported decreased respiration during transcendent experiences. Two articles mention a slower respiration descriptively.[54,68] One article reported significantly slower respiration rate during transcending experiences (11.4 bpm ± .41) compared to other experiences (12.7 bpm ± .43) during meditation.[8]

Two articles examined respiratory suspension. Farrow found 57 respiratory suspension periods in eight expert TM practitioners (mean length = 13.2 s) in one experiment and 151 respiratory suspensions in a further 11 practitioners (mean length = 18.7 s) in a separate experiment,[60] which correlated respiratory suspension episodes with subjective experiences of pure consciousness. Badawi et al.[52] reported increased respiratory suspension in meditators (mean length = 15.4 s) compared to controls in a relaxed state, with eyes closed and voluntarily holding their breath.

Skin

Three studies evaluated skin measures. One study reported significant difference in skin conductance response from two separate studies: (1) comparing transcendent experiences with other experiences and (2) comparing transcendent experiences with inward Stroke.[68] Skin conductance level compared to baseline was not significant in the two other studies.[8,52]

Phenomenological Studies

Phenomenological outcomes were measured by two studies. Ataria reported a case study of one long term meditator (over 40 years and 20,000 h) from the Satipathana and Theravada Vipassana traditions.[51] Specifically, this study focused on the shift between a fixed sense of boundaries and open/flexible sense of boundaries through interviews with participants. Three stages were defined, exemplified here by the descriptions of one participant. The first stage was the default state whereby the participant described having a sense of location or "floating inside his body's boundaries" and can feel and sense his own body independently and separately from the world. The second stage was the dissolving of the sense of boundaries described as a sense of spaciousness, whereby familiar boundaries that are no longer clear, become open, are no longer solid and include a level of flexibility in the inside/outside structure of the self that renders internal and external as irrelevant. Orientation of space begins to dissolve and direction in space becomes less clear and the sense of agency becomes weaker. The third stage included the disappearance of the sense of boundaries limiting communication while the state is ineffable. Other descriptions include a sense of disappearing, of dropping and falling into an empty space, a lack of center and feeling that the person has no real location; "The body is so spread that it's very difficult to know where it is and what it is." All that is left is the "witnessing" of what is happening to him describing himself as the witness. The sense of ownership is lost and there is no "sense of mine" and no sense of "me." The participant does, however, report the ability to maintain knowledge of his "body" even though his consciousness supersedes it. The authors created categories by which to describe the stages: internal vs. external, time, location, self, agency, ownership, and center. They describe that as the participant went into the transcendent state, he experienced: (1) more fluid internal/external ideas about what is outside vs. inside, eventually the experience of "in" fades away; (2) sense of time became distorted and eventually dissipated; (3) sense of location, as the sense of boundaries becomes weaker, space becomes less bodily; (4) sense of self as sense of boundaries becomes weaker the sense of self dissolves and eventually disappears altogether; (5) sense of agency (control). As the sense of boundaries decreases so does the need for agency, and the sense of control eventually disappears completely; (6) sense of ownership, as the sense of boundaries becomes increasingly flexible the sense of ownership becomes weaker; (7) sense of center, as the sense of boundaries decreases, the body ceases to act as a reference point for the outside world; (8) bodily feelings, as sense of boundaries disappears some level of bodily experience remains intact, this remains true even with complete dissolution of sense of boundaries; and (9) touching/being touched, as the sense of boundaries becomes increasingly flexible, the touching-touched structure weakens, yet it does not disappear altogether.

The second phenomenological article combines data from three independent studies, which evaluated yogic meditators experiences during Samadhi, using the Rorschach inkblot test.[58] Those who experienced the transcendent state reported a paucity of associative elaborations; significant decreases in the production of internal images; and concentration on purely perceptual features of the inkblot image. These yogis were primarily attentive to, and occasionally absorbed in, the purely perceptual features of the image, for example, outlines, colors, shades, and inanimate movement. There were also rich descriptions of the differences between the beginner, advanced and Samadhi group. Brown and Engler concluded that the state of Samadhi was a perceptual event.

Description of "Samadhi" and Traditions

Various terms were used in the included studies to describe the transcendent state, depending on the cultural origin of the meditative practice.

Buddhist. Timelessness and spacelessness; Buddhahood; Samadhi; selfless, boundless mode of experience; loss of sense of boundaries; profound joy and happiness; absence of boundaries of time and space; radiance of our fundamental nature, the light of wisdom, or the light of eternal life; true self/identity; deep concentrated states in which awareness is held continuously and steadily upon very subtle activities of the mind, at a level simpler than that of thinking or perceptual pattern recognition.

Christian. Mystical condition; something greater than myself; seemed to absorb me; profound joy; knowing the experience to be sacred; feelings of joy and unconditional love; in a state of union with God.

Vedic: TM. Transcendence, pure consciousness; mental quiescence, absence of thought; absence of space, time and body awareness; ecstasy; transcending the subtlest level of mental activity and experiences a state of complete mental quiescence in which thoughts are absent and yet consciousness is maintained.

Vedic: Yoga. Mental silence; trance state; Samadhi; yogic ecstasy; cessation of mental activity; oblivious to external and internal environmental stimuli although higher nervous activity remains during the state of ecstasy.

Mixed. Attaining a pleasant, peaceful state of mind described by terms such as all-oneness, bliss, oceanic feeling, transcending, expanded consciousness, and letting go; benevolent disregard; nonthought; nonduality; oneness; and transcendence.

DISCUSSION

The purpose of this systematic review was to evaluate phenomenological and experimental studies of transcendent states during meditation across traditions.

Description of Included Studies

Over 600 participants from 25 studies, spanning 60 years of cross-cultural research were recruited by studies in this review. Almost all the studies were in English despite efforts to collect papers in other languages. Our search methods, including mainstream databases, may have limited the discovery of research published in languages other than English. The most common study design measured outcomes of expert meditators in laboratory settings, before, during and after the transcendent state. Studies returned a wide range of quality scores with more recent studies having higher scores. The majority of studies had quality scores of 70 or higher. Only five studies had scores of less than 50. As always, researchers are encouraged to use appropriate study designs, making reference to guidelines to ensure that the study is conducted and reported with a high standard.

Participants

Participants were, on average, 22–53 years of age, comprising over 250 male participants and just over 150 female participants. Some studies recruited low numbers of participants, but most reported data from at least 20 participants. Inclusion and exclusion criteria were not stringent; some studies only included experienced meditators, but most limited exclusions to neurological disease, medical, or mental health conditions. The range of experience in the meditators was also broad. A variety of meditation practices were represented, including those from Buddhist, Christian, and Vedic traditions. Within those, diverse sub-traditions were also included. There was a bias in the overall study pool for Buddhist and Vedic practices. Only two studies researched Christian contemplative traditions, and few studies compared results between traditions. We were unable to find any research evaluating transcendent experiences in the Judaic or Islamic meditation traditions. This is most likely due to a lack of empirical research, with greater prevalence of philosophical texts discussing transcendent states within these traditions. Only three studies incorporated different meditative traditions within their design and pooled the collected data.

Assessing the Transcendent State

One of the most challenging aspects of studying transcendent states is the ability to capture the state during controlled conditions. The studies included in this review engaged different methods for participants to indicate when they were entering transcendent states. These included eye blinks, bell tones, button presses, and subjective self-report. Perhaps the Berman's method of having the participant note when coming out of the state[3] or the Travis's method of bell tones at particular intervals[8] may be the most relevant and useful methods. In addition, respiratory suspension as an objective corollary to transcendent states could be further explored.

Summary of Outcomes Evidence

Transcendent states of consciousness were most consistently associated with respiratory suspension,[52,60] slowed breathing,[8,54,68] and reduced muscle activity.[49,54] EEG data were evaluated by the majority of papers included in this review

(Table 2). The most consistent result was increased alpha power during transcendence. In contrast to other meditative states, transcendent experiences are further associated with increased functional connectivity,[4,55,56] coherence,[69] periods of desynchronization during transitions between states,[67] and whole brain activity. These are experienced as states of relaxed wakefulness in a phenomenologically different space-time.

Detailed Outcome Summary

EEG

Alpha Blocking. Alpha blocking, which was prevalent in at least two studies, has been discussed in the context of transitions between states of consciousness.[13] Alpha blocking is a process, which inhibits alpha waves while increasing beta waves, typically activated when a person opens their eyes.[70] In various studies showing low alpha and increased beta waves, or bursts in beta activity, alpha blocking may have been the context for these outcomes. Alpha blocking is an inhibitory process, which may be related to the reticular activating system.[13] This system functions to mediate transitions between states of consciousness such as sleep-wake cycles. In one study, this process was only absent during transcendent states, when participants were exposed to external stimuli.[13] However, considering that experienced meditators during at least partially transcendent states, perceived motion in otherwise static inkblot images, it would be interesting to see if the participants in Anand's study perceived the external stimuli in a way which differed to typical perception.

Coherence. Four articles reported increased coherence with high variation in the number of channels used, channel pairs and frequencies assessed. Other meditation study reviews that were not focused on transcendent states also found increased coherence, specifically increased alpha-theta range coherence intra- and inter-hemispherically for state effects, and long-term trait effects in long-term meditators at rest or engaged in cognitive tasks.[71]

Power. A number of studies reported changes in power/amplitude in EEG frequency bands, particularly with increases in the alpha and theta frequencies (Table 2). Again, this mirrors what is observed in general meditation reviews.[71] Historically, alpha is associated with states of consciousness such as daydreaming[72] and intrinsic visual perception,[98,73] and is thought to represent activity of the visual cortex in an idle state.[72] It is also associated with relaxation and perhaps novices first learning meditation or earlier states of meditation.[73,74] In contrast to transcendent states, relaxation activates brain areas that consolidate familiar information (the hippocampus and related posterior regions of the brain), while deactivating executive control networks.[2,75] This suggests that in typical relaxation, the brain is not integrating, binding and perceiving potentially novel experiences, which this review suggests, may be the hallmarks of the transcending brain.

Increases in theta power were commonly reported during transcendence, except in studies which measured TM[52,68] and the state of thoughtless emptiness.[63] During states of thoughtless emptiness theta power decreased. Given that theta frequency is associated with a state of preparedness,[76,77] theta is likely to be involved in attention and possibly transitions between states.

Berman and Stevens[3] examined the physiological correlates of nondual experiences in a variety of meditators by comparing EEG 30-s before and after a "wink" signaling the end of a nondual state. There was no EEG difference before and after the "wink," however, the signal just before the "wink" was significantly different to the rest of the meditation session. During nondual states, there were increases in delta, theta, and alpha whereas; the rest of the meditation session was marked by higher beta and gamma frequencies. These data suggest that gamma EEG reported during focused attention meditation may reflect specific procedures, while delta, theta, and alpha may reflect the experience itself.

Gamma is also the frequency band associated with rapid eye movement a feature of dream-state sleep, which corresponds with visual perception and delta activity.[78] Researchers have induced gamma via fast-spiking interneurons driven by optogenetic induction of light.[79] Cardin et al. discuss how gamma oscillations are generated by synchronous ensembles of inhibitory interneurons and they associated the gamma frequency with states of focused attention. Studies which have measured focused attention as a transcendent state, also relate this with gamma[61,63] and with the visual cortex.[61] In Hagerty et al.[61] there were no differences in gamma between transcendence and rest conditions, except in brain regions relating to reward/learning and executive functioning. The observation in Cardin et al.'s[79] study that gamma is induced by an inhibitory process suggests that there is a definitive perceptual form of some kind being processed. Transcendent experiences are difficult to describe beyond the meditation session, yet the brain is functioning optimally during the experience. In one study, rapid eye movement shifted to no eye movement during transcendent experiences, yet the brain continued to show active gamma, and active occipital and motor coordination regions. In Yamakazi et al.[50] study, the transcendent stage of meditation was definitively associated with the occipital lobe. Other meditation studies that are not necessarily during the transcendent state have also found increased gamma during meditation in general.[80]

In two studies conducted by Beauregard and Paquette,[55,56] greater theta and gamma were observed when participants experienced union with God, but not when their transcendent experiences were related to another person.[56] The only studies included in this review which reported a decrease in theta during transcendent states, rather than an increase, were states of thinking during TM[67] and states of thoughtless emptiness.[63] In other studies, increased theta accompanied states that were more akin to the pure consciousness experienced later on in TM.[3,53,56,59,67] In the most common descriptions of transcendence, thoughtless emptiness is not commonly associated with transcendent experiences. In combination, these observations suggest that transcendent experiences have substantial content, which may emerge in stages, and which are associated with frequencies relating to states of attention/preparedness and binding of conscious experience.

Increases in delta were reported by various studies in this review.[3,59,63] Although delta can be active during transcendent states, it is most associated with deep sleep.[81] The wider literature suggests that meditative states are distinctly different than sleep states[71]; given prevalent whole brain activation that reflects typical waking consciousness.[12] Furthermore, phenomenological reports by participants describe these deep states of meditation as ones in which they feel awake and aware[25] evidenced by physiological data.[12]

Progression into Transcendent State. Different stages of meditation were observed as cascading patterns of activity from frontal to parietal and occipital cortex regions of the brain.[50,54,62] Typically, meditation practice begins with relatively low level of alpha at baseline levels.[54] As meditation progresses, a person's sense of agency, location and boundaries in time and space become weaker and the sense of self dissolves.[51] This accompanies changes in physiology (breath rates, respiratory suspensions, and skin conductance), which are similar to states of relaxation, and which may be foundational to the onset of transcendent states of consciousness.[60] There may be globally reduced functional interdependence between brain regions during transcendence that is reflective of minimized self-referential processing.[64] Toward the end of the meditation session, studies have reported short bursts in beta[60] before and immediately after the transcendent state, decreases in coherence across different brain frequencies,[60] and increases in pre-attentive processing.[66] One study reported that divergence between otherwise similar brain states occurs only at the last stage of meditation.[66]

Neuroimaging. The three neuroimaging studies included in this study report that the brain regions most commonly associated with transcendent states were those associated with unconditional love (caudate nucleus and/or insula),[57,59,62,63,82] reward/learning (nucleus accumbens and/or anterior cingulate),[4,55,59,61] motor co-ordination (cerebellum),[57,59,61] space–time structure (temporal areas)[3,55–57,59,61–63,66] perception of self in space and time/mental imagery (parietal lobe),[3,50,53–57,59,62,69] visual processing (occipital lobe),[3,50,53,59] and self-awareness/awake state functioning (central and frontal areas).[8,50,53,56,63,69] While the transcendent state is not localized to the brain, more neuroimaging research with homogeneous methods would further our understanding of potential localization within the brain of the experience.

Changes were also noted in other physiological measures. All three studies reporting on respiration noted decreases in respiration rate during transcendence. They also noted decreased muscle and eye activity. One study even noted respiratory suspension as a marker of transcendent states, emerging roughly ten seconds after the offset of the respiratory suspension episode.[60] One study suggested that autonomic variables may be more robust markers of transcendence than EEG data.[68]

Phenomenological Experience. Five phenomenological studies suggest transcendent-like states distinct from pure Samadhi,[51,54,56,68] and which much of the wider literature does not explore. These states may be gradual transitions over longer time epochs than observed in the included studies. Although different traditions use different terms to describe transcendent states, their phenomenological descriptions are mostly synonymous. Supported by the wider literature, these qualitative reports include a sense of timelessness,[25,51,57] spacelessness,[25,51,61] unconditional love,[55,56] peace,[55,56,59] profound joy,[55,56,61] and loss of boundaries of the self.[51,57,59] In Christian contemplative traditions, there is a "transformative presence of God" and religious ecstasy.[55,56] In support of the wider literature, pure consciousness has been considered as the endpoint of transcendent experience.[1] While some of the research presented in this review addresses different stages of meditation,[8,52–54,61,62,67,69,83] corresponding to different regions of the brain,[61,62,67,68] only one study formally reported on the temporal nature of transcendent experiences. Ataria et al.[51] discuss how transcendence begins with a person's usual sense of boundaries becoming weaker. The sense of agency that is present during typical states of consciousness then dissolves and the body ceases to act as a reference point. In this way, a person transcends the familiar self-referential spatial and temporal constructs of typical waking states. The phenomenological descriptions of transcendent states are also of interest in this context. Language has evolved to reflect personal experience within a relatively static perceptual reality defined by space and time. For example, expressions such as feeling "down" or needing to "get to" grips with something, or finding yourself "back there again" or "looking forward" to tomorrow. In contrast, transcendent states yield descriptions unbounded by these constructs, expressed instead as states of spacelessness, timelessness, joy and peace. These expressions surpass a three-dimensional construct of space–time, yet contain much experience within them. Transcendent states do not lack substance, but perhaps are rich with content that a person may not normally consider. The state is often described as ineffable, which precludes describing it adequately with words. Perhaps consistent, rigorous research with objective measures may be able to elucidate the state in another "language."

Transcendence as a Perceptual Experience. Some studies have considered transcendent states as perceptual experiences.[58] This conceptualization is relatively unique to other studies in this review or in the wider literature. The perceptual transcendence hypothesis would explain the combination of high alpha levels, increased activity over the visual and motor cortex, and brain frequencies associated with rapid eye movement. In the Rorschach inkblot test, experienced meditators tended to perceive motion in the image, yet made less elaborations of the image than those who were not meditators.[58] This unexpected contrast could indicate an environmental offloading of sensory expression,[84] reducing the person's drive for elaboration of the image. Yet, there was also a decrease in the production of internal images reported during transcendent states in this study. During the inkblot tests, meditators were thought to have remained in at least a partial state of Samadhi. In one study, participants perceived an inner light during transcendent experiences,[65] another

strongly perceptual experience which was associated with alpha blockage. Together, these outcomes suggest that transcendence may be a substantial perceptual experience, which gradually emerges during meditation,[61] superseding the constructs of those defined by typical waking consciousness, as a new awake state. This is supported by the observation that long-term meditators experience integrated waking-transcendence states in their day-to-day consciousness. In the present review, transcendent states differ in their profoundness, becoming perceptually richer in more experienced meditators, along a gradient of depth which itself may vary depending on length of practice. Visual perceptual regions of the brain are active during transcendent states, as are brain frequencies associated with rapid eye movement. In this way, the body is "seeing," even if its content is not yet structured by the mind. Increased activity in the temporal lobe may be related to this evolving process, as participants habituate to beyond typical time and space perception. In Hagerty et al.'s study, gamma power unexpectedly did not decrease over the cerebellum, motor cortex, language, visual-auditory or orientation areas, suggesting an emerging conscious experience of perception of motion.[61] The activity in Broca's area reported by Hagerty would suggest that this experience has narrative, or meaning. Some report that in order for meaningful waking experiences to happen, there must be a framework of time, space, and body sense.[8]

During transcendent states, regions of the brain associated with transcending the boundaries of the material body (e.g., out of body experiences) become active.[4] Increased activity in regions related to reward and learning may be due to the experience being meaningful, and not completely novel. In Hagerty et al.'s[61] study, activity in the nucleus accumbens peaked during Samadhi then dropped at later stages of meditation. These findings suggest that transcendence, in its literal meaning, is a superseding, rather than elimination of, or regression to, a previous construct.

In transcendent contexts, psychosis is defined as transliminality, a hypersensitivity to psychological material originating in the unconscious or subliminal region of the mind,[85] which can emerge during or following meditation practice.[86] Experiences occurring at the onset of some psychotic episodes are indiscriminate from transcendent states. These include a heightened sense of knowing, hallucinations, and other perceptual changes[87] considered to be functional and transient by some traditions[87–91] but defined as pathology in Western psychiatry. As such, potentially transcendent states of consciousness may be experienced spontaneously and without preceding spiritual practices prevalent in clinical and nonclinical populations. Drug-induced transcendent states have also been widely studied[92–95] particularly the use of psilocybin and other psychedelics.[43,92,93,96–98] Transcendent experiences are expressed using language that surpasses the constructs of a defining self in dimensional space–time. The language used expresses a profound sense of being.[8] Transcendent experiences may therefore reflect a perceptual space, which is novel to the sense of body, but not to the sense of being. This may explain the activity of the cerebellum and motor areas of the brain, attaining a state of preparedness as the vehicle for expression of unchartered space.

In assessing the origins of this experience, it is clear that the ecstatic nature of some transcendent states, and the reward networks involved, relate directly to pleasure or love of an experience. In contrast, the distress associated with conditions of pathological psychosis may emerge from an attenuation to primordial states of fear[99] advancing extrasensory capacities that may otherwise be operating in the background of typical or transcended people. ECG studies were limited and did not reveal consistent results. Future studies examining ECG during the transcendent state may support our understanding of how the heart and neural circuitry may be interacting and/or involved in feelings of love or fear. In a number of studies, feelings of unconditional love, joy and peace were associated with increases in gamma[56,61] and theta[3,53,56,57] in regions relating to body sense,[3,56,57] which may contribute to a deeper understanding of the function of love. An interesting pilot study examining loving-kindness meditation which focuses on cultivating a loving heart, observed reduced stress levels, increased relaxation, and beneficial effects on nitric oxide metabolism, a key mediator of cardiovascular physiology associated with vasodilation.[100] More research is definitely warranted in this area. Given the observation of neurophysiologically different stages of meditation[8,52–54,61,62,67,69,83] and the parsing of transcendence itself into different states,[51,54,56,68,82] studies which do not collect detailed phenomenological data from participants may miss the finer differences of transcendent expression between different traditions in their processing of the raw data. Additional factors future research could consider including the possibility that more experienced meditators are more likely to enter into deeper transcendent states more often,[69] that there may be unexplored stages of transcendence elicited potentially by different types of practice, and that these differences may be more prevalent than contrasts in generalized phenomenological experiences. For example, in Travis and Shear, different types of meditation produced similar physiological outcomes between different traditions (e.g., focused attention was characterized by beta/gamma activity, which was more prominent in Tibetan Buddhist, Buddhist, and Chinese practices).[31] In the present review, focused attention was also most associated with gamma.[63] On the other hand, open monitoring, has been characterized mainly by theta activity and included meditations from Buddhist, Chinese, and Vedic traditions. Although only one study included in this review defined open monitoring meditation,[63] a number of studies may indirectly be describing this form of practice. This may also be true for automatic self-transcending, characterized by alpha1 EEG activity (8–10 Hz) by Travis and Shear.[31] The current review recommends that while different traditions could be successfully combined, outcomes from different practices within each tradition could be parsed into separate conditions, in order to delineate finer brain states and for these to be correlated with different stages or states of transcendent experience. TM may reveal differential aspects of meditative and transcendent experiences, given the definitive stages of the practice that other practices do not explore, or may not develop.

Limitations of the present review include potential cultural bias. Almost all the studies were in English, despite efforts to collect papers written in other languages, very few were found. Most of the outcomes had too few studies examining them to draw robust conclusions, although an overall picture has emerged from the data. Many studies did not report on all outcomes for each condition or describe the temporal context of general meditation-to-transcendent state and beyond. Some studies did not consider meditation stages at all, while others distinguished different stages of the transcendent state itself. Furthermore, given the processing of raw phenomenological data, many studies may have missed the finer differences of transcendent expression between different practices within their traditions. These additional insights may help to navigate data analysis of parsed transcendent states, which may be more likely to vary between participants, than between conditions. Future research could therefore focus on practice type, more than cultural tradition. Future research could also consider that highly experienced meditators may not show the same baseline post-meditation differences, compared to less experienced meditators, given that they may have attained an integrated transcendent state in their day to day consciousness. Some personality types may also be more amenable to, or expressive of, transcendence than others.[101] Evaluating these factors in future studies would be useful.

In conclusion, the present review concludes that transcendence most commonly describes an experience associated with deeper stages of meditation and across traditions. Transcendence is a process of becoming selfless but enriched with joy and profoundness, in a way which supersedes traditional boundaries of self and the world. Increases in theta and gamma, and fluctuations in alpha, reflect the opening of an integrating, superseding perceptual reality that does not estrange the three-dimensional world, but rather transcends it. We also observe that transcendent states are not limited to meditation but can also occur spontaneously, be drug induced, and associated with pathology. More discussion and research is needed in this area not only in the meditation science field but elsewhere. Through this effort we may support unbiased observation and study of transcendent states, whether they manifest from religious or spiritual traditions or practices or through other less socially accepted practices such as DMT and psilocybin.

APPENDIX A. SUPPORTING INFORMATION

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.explore.2017.07.007.

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