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Mini Review

Music-based interventions in Alzheimer's and Parkinson's disease

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Abstract

Alzheimer's disease (AD) and Parkinson's disease (PD) constitute a leading cause of disability and death worldwide. Millions of people are currently afflicted with AD and PD with numbers expected to double by mid-century, if effective disease-modifying treatments do not become available. There is no cure for AD or PD. Current Food and Drug Administration (FDA)-approved treatments are symptomatic which do not halt the progression of the disease and are associated with adversities. These limitations have prompted the emergence of alternative therapies although with moderate benefits but with least or no side effects. Music-based interventions (MBIs) are one of such alternative therapeutic options increasingly being considered for treating AD and PD. Not only experimental work but also clinical trials have shown benefits of MBIs. National clinical trial registry has documented successful completion of many clinical trials that involved the use of MBIs in AD and PD. The benefits of MBIs are attributed to the versatile features of music. Different components of music such as pitch and tempo, produce differential effects on brain chemistry, human emotions, brainwave patterns, and overall well-being. Postulated mechanisms fundamental to the benefits exerted by MBIs in treating AD and PD are discussed.

Keywords: Alzheimer's disease, Dementia, Parkinson's disease, Brainwaves, Musical tempo, Musical pitch, Rhythmic auditory stimulation

Abbreviations: AD: Alzheimer's Disease; ADRD: Alzheimer's Disease Related Dementias; ARIA: Amyloid Related Imaging Abnormalities; BDNF: Brain-Derived Neurotrophic Factor; BPSD: Behavioral and Psychological Symptoms of Dementia; bpm: Beats Per Minute; COMT: Catechol-O-Methyltransferase; FDA: Food and Drug Administration; PD: Parkinson's Disease; MAO-B: Monoamine Oxidase B; MBI: Music-Based Interventions; NCT: National Clinical Trial; ND: Neurodegenerative Diseases; NGF: Nerve Growth Factor; NMDA: N-Methyl-D-Aspartate; NMT: Neurologic Music Therapy; RAS: Rhythmic Auditory Stimulation

Introduction

Alzheimer's disease (AD) and Parkinson's disease (PD) are the two most common neurodegenerative diseases, impacting millions of people worldwide and the number of people living with AD/PD is expected to double by 2050 [1]. The most recent reports indicate that AD and Alzheimer's disease related dementia (ADRD) are prevalent in >7 million Americans [2] and ~60 million people worldwide [3–5], while PD is prevalent in >1 million Americans and >10 million people worldwide [6,7]. By the mid-century, these numbers are projected to stagger by 14 million Americans and 153 million people worldwide suffering from AD/ADRD [5,8], and ~3 million Americans and >12 million people worldwide afflicted with PD [6,9], if effective disease-modifying treatments are not discovered [2,7]. Current U.S. Food and Drug Administration (FDA) approved treatments for AD include Acetylcholinesterase inhibitors (Donepezil, Rivastigmine, Galantamine), N-Methyl-D-Aspartate (NMDA) glutamate receptor modulators-alone (Memantine) or in combination (Memantine + Donepezil) known as or Namzaric, anti-insomnia drugs (Suvorexant or Belsomra), atypical anti-psychotic drugs (Brexpiprazole or Rexulti), and anti-amyloid antibodies (Lecanemab or Leqembi, Donanemab or Kisunla) (**Table 1**). As detailed in the most recent 2025 Alzheimer's facts and Figures

Table 1. High profile AI-mediated suicides.

Alzheimer's Treatment	Asymptomatic Changes Stages (0-2)	Mild Cognitive Impairment (MCI) Stage 3	Mild Dementia Stage 4	Moderate Dementia Stage 5	Severe Dementia Stage 6
Donepezil (Aricept)			Symptomatic Cognition	Symptomatic Cognition	Symptomatic Cognition
Rivastigmine (Excelon)			Symptomatic Cognition	Symptomatic Cognition	Symptomatic Cognition
Galantamine (Razadyne)			Symptomatic Cognition	Symptomatic Cognition	
Memantine (Nameda)				Symptomatic Cognition	Symptomatic Cognition
Memantine + Donepezil (Namazaric)				Symptomatic Cognition	Symptomatic Cognition
Suvorexant (Belsomra)			BPSD	BPSD	
Brexpiprazole (Rexulti)			Mood Stabilization BPSD	Mood Stabilization BPSD	Mood Stabilization BPSD
Lecanemab (Leqembi)		Slow Disease Progression	Slow Disease Progression		
Donanemab (Kisunla)		Slow Disease Progression	Slow Disease Progression		

AD: Alzheimer's Disease; ADRD: Alzheimer's disease related dementia; BPSD: Behavioral and Psychological Symptoms of Dementia

[2], Donepezil, Rivastigmine, Galantamine and Memantine (single or in combination) do not slow, stop or reverse the disease process or affect the course of the disease and may have side effects such as headaches and nausea. The anti-psychotic drug Brexpiprazole may increase the risk of psychosis and stroke while Suvorexant may impair alertness and motor coordination and worsen depression or suicidal thinking. Anti-amyloid treatments with Lecanemab and Donanemab can cause serious allergic reactions as well as amyloid-related imaging abnormalities (ARIA), infusion-related reactions, headaches and falls. Non-drug treatments, on the other hand, can reduce behavioral and psychological symptoms of dementia (BPSD) more effectively than pharmacological drugs [10].

FDA-approved drugs for PD consist of three major types of treatments including Dopamine replacement (Levodopa, Levodopa/Carbidopa), Dopamine agonists (Pramipexole, Ropinirole, Apomorphine, Rotigotine), Monoamine Oxidase B (MAO-B) inhibitors (Safinamide, Rasagiline, Selegiline). Catechol-O-Methyltransferase (COMT) inhibitors (Entacapone, Tolcapone, Opicapone), Combined Dopamine precursor, Dopamine decarboxylase inhibitor, COMT inhibitor (Stalevo), and Amantadine and Istradefylline for dyskinesia. The newer treatments include subcutaneous dopaminergic infusions (Vyalev, Onapgo), adaptive deep brain stimulation and focused ultrasound. Dopamine replacement drugs are associated with nausea, dizziness, orthostatic hypotension, swelling of ankles, anxiety, dyskinesia, confusion, hallucination, sleep disturbances [11,12]. MAO-B and COMT add on therapies are associated with diarrhea and liver dysfunction in addition to the side effects mentioned for as Dopamine replacement therapies [11,13]. Amantadine and Istradefylline pose a risk of kidney dysfunction in addition to above-mentioned adversities [14]. Deep brain stimulation leads to cognitive deficits [15] while focused ultrasound may lead to lingual dystonia and speech problems [16]. As evident, all approved therapies for treating AD/ADRD and PD provide only symptomatic relief and do not slow the progression of the diseases [17,18], making AD/ADRD and PD, clinically unmanageable [2,19]. Given these limitations [18, 19], non-pharmacological alternatives in treating NDs are emerging [20–22]. In that regard, Music based interventions (MBI/MBIs) are gaining increasing recognition as an effective non-pharmacological alternative in treating neurological disorders [23,24].

Music-Based Interventions (MBIs)

MBIs are broadly classified into two major categories i.e. active and receptive MBIs [25,26], and a recently emerging third category known as "Neurologic Music Therapy" comprising of structured congregation of active and receptive MBIs [24,27–29]. Active MBIs consist of activities such as singing, drumming, playing musical instruments, moving/dancing to the music-tunes or improvising, etc. [30]. The rhythmic auditory stimulation (RAS) is a prominent feature of active MBIs, known to restore brain's rhythms through the use of rhythmic cycles with defined beats per minute (bpm) [31, 32]. Unlike active MBIs, receptive passive listening of music, involves passive listening to live or recorded music chosen by a patient or therapist [33]. Neurologic Music Therapy (NMT) uses specific elements of all types of active and/or receptive MBIs such as rhythm, melody, dynamics, and tempo aimed at achieving non-musical therapeutic goals towards improving speech, cognitive, motor and other functional impairments in treating NDs [24,34,35]. There have been a considerable number of clinical trials that tested the effects of different types of MBIs in AD/ADRD and PD (**Tables 3** and **4**). With the exception of couple of studies, most MBI interventions were observed to exert positive effects.

Table 2. U.S. Food and Drug Administration (FDA)-approved treatments for PD.

Parkinson's Treatment	Early PD Stages 1	Mild PD Stage 2	Moderate PD Levo/Carbidopa wear out begins Stage 3	Severe PD Levo/Carbidopa desensitization Stage 4	Severe PD Stage 5
Levodopa (Inbrija) (Inhalation)	Motor Symptoms	Motor Symptoms			
Carbidopa/Levodopa (Sinemet, Dhivy), subcutaneous (Vyalev)	Motor Symptoms	Motor Symptoms			
Dopamine agonists (Mirapex, Requip, Apokin, Onapgo, Neupro)	Motor Symptoms	Motor Symptoms			
Monoamine Oxidase B inhibitors (Safinamide, Rasagiline, Selegiline)	Motor Symptoms	Motor Symptoms			
Catechol-O-Methyltransferase inhibitors (Comtan, Tasmar, Ongenty)	Motor Symptoms	Motor Symptoms			
Combined dopamine precursor, Dopamine decarboxylase inhibitor, COMT inhibitor (Stalevo)			Overcome Levo/ Carbidopa Ineffectiveness	Overcome Levo/ Carbidopa Desensitization	Overcome Levo/ Carbidopa Desensitization
Amantadine and Istradefylline			Add-on for Severe motor dyskinesia	Add-on for Severe motor dyskinesia	Add-on for Severe motor dyskinesia
Deep Brain Stimulation			Severe Motor Dyskinesia	Severe Motor Dyskinesia	Severe Motor Dyskinesia
Focused Ultrasound				Motor Deficits (Experimental)	Motor Deficits (Experimental)

PD: Parkinson's Disease; MAO-B: Monoamine Oxidase B; COMT: Catechol-O-Methyltransferase

Table 3. MBIs in Alzheimer's Disease and Related Dementias (AD/ADRD).
COMPLETED NCTs (ClinicalTrials.gov)
(Other Status: Unknown, Terminated, Active-but not Recruiting, Recruiting – Results Not Posted/Available – Hence Not Included)

NCT #	Truncated Title	Interventions	Key Findings
NCT04645017	Music Program to Older Adults with Declining Cognition	BEHAVIORAL: Intergenerational Music Program	Improved Emotional Well-being, Sociability, Quality of Life
NCT05317910	Music Therapy on Anxiety of Caregivers of Alzheimer's Patients	OTHER: MUSIC CARE	Increased cortical activity, Increased alpha and beta EEG power
NCT05125536	The Effect of Music in Alzheimer's Patients	OTHER: Music Therapy	Decreased adaptation difficulty
NCT04761497	Group Music Therapy on Alzheimer's Disease Patients	Active & Passive Music Therapy, Watching Nature Videos	Improved cognition, Reduced BPSD, Enhanced Functional State
NCT03011723	Tailored Music Therapy for Dementia	BEHAVIORAL: Resource Oriented Music Therapy	Improved Emotional Well-being and Sociability
NCT06596278	Memesto Wearable Music Therapy Device Reduces Agitation in AD	DEVICE: Memesto	Reduced Agitation
NCT05309369	Musical Engagement of Brain Lobes in Alzheimer's Patients	BEHAVIORAL: Preferred Music, Nature Sounds	Improved Brain Connectivity (fMRI), Improved Clinical Global Impression
NCT05153161	Memesto Wearable Device for Persons with Dementia	DEVICE: Memesto	Reduced Agitation
NCT06765434	Effects of Personalized Music Listening in Advanced Alzheimer's	Music (Dmitri Shostakovich's Jazz Waltz Suite), Personalized Music	Improved Standardized Mini-Mental State Examination (SMMSE) Scores
NCT03643003	Music Therapy for Persons with Dementia	BEHAVIORAL: Music Therapy, Non-Music Verbal Interaction (Placebo)	Feasibility and Acceptability of Music Therapy Successfully Demonstrated
NCT00759863	LifeZig Personalized Music for Alzheimer's and Dementia	BEHAVIORAL: LifeZig Music	Improved Quality of Life
NCT04308512	Care Coordination System for People with Dementia	BEHAVIORAL: Active Nili device, Passive Nili system	Feasibility and Acceptability of Nili Device Successfully Demonstrated

NCT #	Truncated Title	Interventions	Key Findings
NCT03907748	Home-Based Music and Reading Interventions for Dementia	OTHER: Music Intervention, Reading Intervention (Placebo)	Neither Music nor Reading Significantly Reduced BPSD
NCT05508646	Group-Based Telehealth Music Therapy for Dementia	BEHAVIORAL: Music Therapy, Personalized Music CD	Reduced BPSD, Agitation, and Depression
NCT04850807	Music & MEmory: A Pragmatic TRial for ALzheimer's Disease (METRIcAL)	BEHAVIORAL: Music & Memory	No Significant Difference in Study Outcomes than Controls
NCT04157244	The Music, Sleep and Dementia Study	BEHAVIORAL: Tailored Music Listening Intervention	Interventional Feasibility and Acceptability, Improved Insomnia
NCT07069530	Musical Therapeutic Intervention on Depression in Dementia Patients	BEHAVIORAL: Receptive Music Therapy	Improved Depression in Dementia Patients, Reduced Caregiver Burden
NCT02833870	Non-Pharmacological Music Interventions in Alzheimer's Disease	BEHAVIORAL: Music intervention, No Intervention (Placebo)	Mood Upliftment but No Effect on Cognition
NCT04769024	Virtual Reality Intervention for the Reduction of BPSD	DEVICE: LUMEEN Virtual Reality, Non-Digital Stimulation (Placebo)	Interventional Feasibility and Acceptability, Reduced BPSD
NCT03284112	Old SCHOOL Hip-Hop: Improve Alzheimer's Disease	BEHAVIORAL: Old SCHOOL Hip-Hop	Reduced Auditory Hallucinations and Depression
NCT02518243	Safe & Easy for Alzheimer's Disease and Related Pathologies	OTHER: Non-Pharmacological Music Therapy	Feasibility and Acceptability of Music Therapy Successfully Demonstrated
NCT05627687	Caring Relationships Expression Study	BEHAVIORAL: Heart Rate Variability Biofeedback, Music Listening Control	Feasibility and Acceptability of Music Therapy Successfully Demonstrated
NCT03333837	Improvisational Movement for People With Memory Loss	BEHAVIORAL: Dance Group, Social Group	Improved Quality of Life and balance, Increased Brain Network Efficiency
NCT06530277	REMINDer - A Digital Environmental Enrichment Intervention	BEHAVIORAL: Reminder (A Digital Environmental Enrichment)	Improved Multi-Domain Health and Lifestyle Behaviors

AD: Alzheimer's Disease; ADRD: Alzheimer's Disease Related Dementia; BPSD: Behavioral and Psychological Symptoms of Dementia

Table 4. MBIs in Parkinson's Disease (PD).

COMPLETED NCTs (ClinicalTrials.gov)

(Other Status: Unknown, Terminated, Active-but not Recruiting, Recruiting – Results Not Posted/Available – Hence Not Included)

NCT #	Truncated Title	Interventions	Key Findings
NCT03434496	Music Role in PD Rehabilitation	DEVICE: Gait Trainer 3	RAS Treadmill Training Significantly Improved Gait Performance
NCT05421624	Amplifying Physical Activity through Music in Parkinson Disease	DEVICE: Digital Music Therapeutic, Active-Control	RAS Significantly Improved Walking Intensity and Stride-Lengths
NCT00750945	Treadmill and Music Cueing for Gait Training in Parkinson's Disease	Music and Treadmill Walking Program	Treadmill and Music Cueing Improved Gait
NCT04966689	Effect of Speech and Music-therapy in Parkinson's Disease (PD)	BEHAVIORAL: Combined Speech and Music Therapy	Voice Intensity, Shimmer Frequency Improved
NCT04246476	Sing for Your Saunter	BEHAVIORAL: Mentally Singing, Listening to Music	Gait Speed and Stride Length Improved
NCT04518917	Sing for Your Saunter PD-Dementia Supplement	BEHAVIORAL: Mentally Singing, Listening to Music	Improved Stride Length and Velocity
NCT04891107	Feasibility of MR-005 in Parkinson's Disease	BEHAVIORAL: Walking with a Music-Rhythm-Modulating Wearable System	Improved Walking, Functional Mobility, and Quality of Life
NCT03253965	Effects of Auditory Cues on Gait in Parkinson's Disease	Metronome Normal, Slow, Fast, No Auditory Cueing (Controls)	Increase/Decrease Cadence in Response to Music, Longer Strides
NCT05157074	Group Drum-Music Therapy for Parkinson's Disease	BEHAVIORAL: Group Drumming Music Therapy	Drum-RAS Enhanced Movement and Improved Quality of Life
NCT05585489	Individualized Music-Based Cueing for Gait in Parkinson's Disease.	OTHER: Gait Training with Musical Cue	Musical Cues Improved Gait

NCT #	Truncated Title	Interventions	Key Findings
NCT02999997	Evaluation of Ronnie Gardiner Method in Parkinson's Disease	BEHAVIORAL: Ronnie Gardiner Method (RGM)	Improved Measures of Fall Fear and Quality of Life
NCT06063161	Music Therapy to Prevent Delirium in Parkinson's Disease	BEHAVIORAL: Music Therapy, Standard Care (Control)	Partially Successful in Preventing Hospital Acquired Delirium
NCT06896123	Dance Well Therapy: Evaluating Efficacy, Safety, and Feasibility	BEHAVIORAL: Dance, Conventional Motor Therapy (Control)	Found Feasible for Improving Motor, Cognitive, and Emotional Symptoms
NCT05769972	Cognitive Rehabilitation with Virtual Reality, Computer-Stimulation	DEVICE: Computer-Based Cognitive Rehabilitation, Music-Therapy	Improved Default Mode Network Connectivity and Cognition
NCT05446194	Vestibulopathy, Imbalance, and Gait Disturbances in Parkinson Disease	DEVICE: Non-Invasive Neuromodulation Devices	Improved both Balance and Gait
NCT02753621	Parkinsonism: A Controlled Study of Group Singing in Parkinson Disease	BEHAVIORAL: Group Singing, Discussion Group (Control)	Improved Emotional Well-Being
NCT01151111	Relaxation Guided Imagery for Treatment of Parkinson's Disease	BEHAVIORAL: Relaxation Guided Imagery	Improved Motor Fluctuations
NCT03228888	Rhythmic-Auditory Stimulation (RAS) in Parkinson's Patients	OTHER: Rhythmic Acoustic Stimuli for Gait Training	Improved Motor Functions and Gait
NCT02457832	Motor Training in PD	BEHAVIORAL: Adapted Tango Dancing, with Behavioral Control	Improved Physical Functions and Quality of Life
NCT01939717	A Randomized Controlled Pilot Trial of Dancing in Parkinson's Disease	OTHER: Dance Group	A Safe, Feasible intervention that Improved Quality of Life
NCT01757509	A Randomized Controlled Dancing Trial in Parkinson's Disease	OTHER: Dance Intervention Group	Improved Motor Functions, Balance, Gait, Rigidity, and Bradykinesia
NCT03316365	Effects of Rhythmic Auditory Stimulation on Parkinson's Gait	OTHER: Rhythmic Auditory Stimulation (RAS)	Improved Gait, Reduced Falls, and Boosted Motor Performance

PD: Parkinson's Disease; RAS: Rhythmic Auditory Stimulation

Potential Mechanisms of Actions of MBIs

As therapeutic potential of music continues to grow, it is integral to understand the biological mechanisms by which music influences health. MBIs are postulated to work mainly through neurochemical, neuroplastic, brain-entraining and emotional mechanisms [36].

Neurochemical mechanisms

MBIs influence brain neurochemistry by modulating key neurotransmitters (Dopamine, Serotonin, Endorphins, Endocannabinoids), neurohormones (Oxytocin, Cortisol, Melatonin, Adrenaline/Epinephrine, Prolactin) and neurotrophic factors—Brain-Derived neurotrophic Factor (BDNF), and Nerve Growth Factor (NGF) [27,37,38]. MBIs influence induction of key neurotransmitters such as dopamine and serotonin during happy and pleasurable musical experiences [39]. Dopamine is a key neurotransmitter involved in the brain's reward and pleasure system involving dopaminergic brain regions i.e. nucleus accumbens, ventral tegmental area, caudate, ventral striatum, midbrain, amygdala, orbitofrontal cortex, and ventral medial prefrontal cortex [40,41]. The caudate is known to be involved during the anticipation and the nucleus accumbens during the experience of peak emotional responses to music, indicating that intense pleasure in response to music can lead to dopamine release in the striatal system [42]. Moreover, the anticipation of such abstract reward is postulated to result in dopamine release in an anatomical pathway distinct from the pleasure-pathways such as limbic system comprised of nucleus accumbens, ventral tegmental area, amygdala, hippocampus, and cortex [43]. Thus, music-induced dopamine release is associated not only with pleasure and motivation but also with cognition [44]. Serotonin is a neurotransmitter that not only induces the feelings of well-being and happiness, but also is implicated in mood, anxiety, depression, psychosis and cognition [45,46]. Listening to pleasant music was shown to elevate serotonin while listening to unpleasant music was shown to elevate adrenocorticotropic hormone, and sad music was associated with the induction of prolactin [47]. In addition to the pleasantness, "relaxing serene consonance" along with the tempo range between 60–80 is known to facilitate the induction of serotonin and oxytocin [39,48]. Oxytocin is the hormone associated with social bonding and trust. Shared musical experiences can stimulate oxytocin release, fostering social bonding [37,45]. Listening to soothing music can increase oxytocin levels [39,49]. Music-based interventions may increase serotonin levels, helping to balance emotions, stress, anxiety and depression, enhancing social connectedness.

Endorphins are body's natural opioids that reduce cell excitability and neurotransmission thus leading to the reduction of pain and feeling of well-being [50]. Endorphins are released in response to music impacting reduction in the feeling of pain [51], promoting neurological healing [52]. Music therapy has been shown to elevate serum melatonin levels in patients with Alzheimer's disease [53]. Pleasurable and relaxing music listening is associated with the upregulation of neurotrophic factors such as BDNF and NGF related to neuroregeneration and synaptic plasticity [27]. On the other hand, techno-music with high tempo is shown to induce Adrenalin/Norepinephrine, Cortisol, Adrenocorticotropic hormone, and growth hormone [54]. Thus, MBIs play a critical role in neuroprotection and general well-being.

Neuroplasticity

MBI interventions can enhance neuroplasticity and promote beneficial gene expression related to brain repair and function [27]. Music has a distinctive ability to simultaneously activate multiple brain regions and pathways [55]. Studies suggest that MBIs engage multiple cortical and subcortical networks, comprehending perceptual, sensorimotor, cognitive, and emotional processing of musical stimuli [27, 56, 57]. Positron emission tomography and functional magnetic resonance imaging have revealed that listening to pleasurable music activates cortical and subcortical cerebral areas where emotions are processed [58]. Music-mediated induction of BDNF can activate neurogenesis and neuronal proliferation, resulting in synaptic re-modelling and boosting cognition [59, 60]. Music is known to facilitate neuroplasticity, protect against cognitive decline, and promote stress resilience via enhancement of neurogenesis, synaptic plasticity, and neurotrophic factor expression (BDNF, NGF) [61]. Music-induced neuroplastic changes can occur across the lifespan, producing long-term effects strengthening of neural pathways through experience and practice, possibly extending over decades [62,63].

Brain entrainment

Brain entrainment to musical rhythm is conceptualized to underlie the process of the perception of music [64]. Music utilizes temporal sensitivity of auditory system and its coupling to neuronal networks to facilitate the process of brain entrainment [65]. Music can stimulate motor, cognitive and emotive networks entraining listeners in real time [66]. Globally increasing burden of neurological disorders such as AD and PD often experiences psychiatric symptoms with changed brainwave patterns [29]. Therefore, the brain-entraining ability of music is considered to have clinical application in rebalancing altered brainwaves of neurodegenerative diseases [29]. Music-mediated rebalancing of altered brainwaves is mainly achieved through musical reward and pleasure [67,68] and through rhythmic auditory stimulation in the form of tempo or beats per minute (bpm) [69,70]. The slow soothing music >60 bpm tempo activates theta brainwaves [71] and decreases delirium duration [72]. The reward and pleasurable music with ~80–120 bpm activates alpha waves [71,73,74], music with >120–150 bpm stimulates beta waves [75], while music with >150 bpm activates gamma waves [71]. Moreover slow-tempo music facilitates strong brain synchronization [76], and different music tempi modulate different emotional states [71].

Emotional stabilization

Neurological disorders often begin with emotional, behavioral and psychological disturbances [77]. Considering the ability of music in influencing human emotions [71], music can play a big role by exerting calming and emotional stabilizing effects [78]. Tempo is an important musical element that affects human's emotional processes when listening to music [71,79]. Slow-tempo (~60 bpm) relaxing music is shown to increase oxytocin promoting socialization and decrease cortisol leading to reduced anxiety [80]. While medium tempo (~60–120 bpm) music produces cheerful/happy/pleasure effects and fast tempo (>150 bpm) music produces excitement [79,81,82]. Alzheimer's disease (AD) is associated with impaired emotional memory and music has been shown to enhance emotional memory [83]. Thus, music offers a promising alternative for improving emotional state, quality of life and overall well-being [84], and reduce depressive symptoms [35]. Overall, music has been perceived as a positive intervention with potential psycho-emotional benefits [85].

Conclusions

Music-based interventions (MBIs) significantly impact the brain by modulating neurotransmitters, brainwave activity and emotions. Different components of MBIs affect differentially by inducing selective neurotransmitters, activating specific brainwaves, and exerting different emotions, together facilitating brain's neuroplasticity, improving brain-network connectivity and emotional stabilization.

Author Contributions

All authors contributed equally.

Conflict of Interests

Author declares no conflict of interest.

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