Look for actual studies on the effects of death metal, and the effects of classical music on subjects - respectively. Compare.

Classical music shows consistent cardiovascular and psychological benefits across extensive research, while death metal remains largely unstudied with only two fan-focused investigations, and the four direct comparison studies produced inconsistent results, making evidence-based comparison between genres impossible due to the massive imbalance in available evidence.

Abstract

Only four of 25 identified studies directly compared classical music with heavy metal or death metal effects, revealing inconsistent findings. The most rigorous controlled trial found classical music (Bach) produced significantly greater reductions in blood pressure (systolic: 128.3 to 120.8 mm Hg; diastolic: 81.9 to 77.0 mm Hg, p<0.001) and heart rate (75.3 to 67.8 bpm, p<0.001) compared to heavy metal (Disturbed), while three other direct comparison studies found no significant cardiovascular differences between baroque or classical music and heavy metal. Studies examining classical music alone (n=19) consistently demonstrated cardiovascular benefits including reduced blood pressure, heart rate, and anxiety across diverse populations including surgical patients, cancer patients, and healthy volunteers, with psychological improvements in anxiety (p<0.001) and quality of life (p<0.001) persisting for hours to months. Death metal research was limited to two studies examining fan populations, which found death metal promoted positive affect, prosocial intentions, and social relatedness among fans, with expertise enhancing lyrical intelligibility from 51.04% to 65.88%. The evidence indicates classical music at moderate volumes (60-70 dB) for 20-30 minutes provides reliable benefits in clinical populations, but the near-absence of heavy metal studies in non-fan or clinical populations, combined with substantial methodological heterogeneity in music selection, intensity levels, and measurement timing across direct comparisons, prevents definitive conclusions about the relative superiority of either genre. Effects appear to depend critically on listener preference, cultural context, and baseline stress levels rather than inherent genre properties.

Paper search

We performed a semantic search across over 138 million academic papers from the Elicit search engine, which includes all of Semantic Scholar and OpenAlex.

We ran this query: "Look for actual studies on the effects of death metal, and the effects of classical music on subjects - respectively. Compare."

The search returned 500 total results from Elicit.

We retrieved 500 papers most relevant to the query for screening.

Screening

We screened in sources based on their abstracts that met these criteria:

- **Music Genre Exposure**: Does the study involve human participants exposed to death metal music or classical music (either or both genres)?
- **Genre Definition**: Is the music clearly identified and defined as death metal or classical music (not mixed with other genres)?

- **Quantifiable Outcomes**: Does the study measure quantifiable effects or outcomes following music exposure (psychological, physiological, cognitive, or behavioral)?
- **Study Design**: Is the study design experimental, quasi-experimental, observational, systematic review, or meta-analysis?
- **Music as Primary Intervention**: Is music exposure used as the primary intervention rather than as background or control condition?
- **Single Genre Focus**: Does the study avoid examining mixed music genres or playlists containing multiple genres within the same intervention?
- **Non-Clinical Music Therapy**: Is the study focused on music exposure effects rather than structured music therapy interventions with clinical treatment protocols?
- **Publication Type**: Is the publication a full research study rather than a case report, editorial, opinion piece, or conference abstract?

We considered all screening questions together and made a holistic judgement about whether to screen in each paper.

Data extraction

We asked a large language model to extract each data column below from each paper. We gave the model the extraction instructions shown below for each column.

- **Music Types Tested**:

  Extract the specific types of music tested in the study, including:

- Classical music pieces (composer, title, duration if specified)
- Death metal/heavy metal pieces (artist, song title, duration if specified)
- Any control conditions (silence, noise, other music types)
- Music exposure duration and intensity/volume levels
- Delivery method (headphones, speakers, live performance)

- **Study Population**:

  Extract details about the study participants, including:

- Sample size for each music condition
- Age range and mean age
- Gender distribution
- Health status (healthy subjects, patients with specific conditions)
- Any exclusion criteria related to hearing, music experience, or medical conditions
- Geographic/cultural context that might affect music perception

- **Cardiovascular Effects**:

  Extract all cardiovascular outcomes measured for classical music versus death metal/heavy metal, including:

- Blood pressure changes (systolic, diastolic) with specific values and statistical significance
- Heart rate changes with specific values and statistical significance
- Heart rate variability measures (HRV indices, geometric measures)
- Any other cardiac parameters measured
- Direction of effect (increase, decrease, no change) for each music type
- Time points when measurements were taken (during, immediately after, hours later)

- **Neurological Effects**:

  Extract all brain activity and neurological outcomes for classical music versus death metal/heavy metal, including:

- EEG findings (alpha, beta, theta rhythm changes)
- Brain imaging results if any
- Autonomic nervous system measures
- Any cognitive or attention measures
- Specific findings comparing the two music types
- Statistical significance of differences between music types

- **Psychological Effects**:

  Extract all psychological and mood-related outcomes for classical music versus death metal/heavy metal, including:

- Anxiety levels and changes (measurement scales used, specific values)
- Mood changes (depression, well-being, emotional state)
- Pain perception changes
- Stress-related measures (cortisol, perceived stress)
- Any other psychological parameters measured
- Comparative effects between the two music types with statistical significance

- **Study Design**:

  Extract methodological details that affect the validity of music comparisons, including:

- Study design type (randomized controlled trial, crossover, observational)
- Randomization method and blinding procedures
- Control group type and size
- Washout periods between different music exposures
- Measurement timing (baseline, during music, post-music intervals)
- Statistical methods used for comparing music types
- Any potential confounding factors addressed

- **Direct Comparisons**:

  Extract any direct statistical comparisons made between classical music and death metal/heavy metal effects, including:

- Head-to-head comparison results with p-values or effect sizes
- Which music type showed superior effects for each outcome measure
- Magnitude of differences between music types
- Author conclusions about relative effectiveness
- Any subgroup analyses comparing music effects in different populations
- Interaction effects between music type and participant characteristics

- **Key Findings**:

  Extract the main conclusions about classical music versus death metal/heavy metal effects, including:

- Overall summary of which music type was more effective for each outcome domain

- Clinical or practical significance of observed differences
- Author recommendations about music selection for specific purposes
- Any unexpected or counterintuitive findings
- Limitations that affect interpretation of music comparisons
- Future research recommendations for comparing these music types

Results

Characteristics of Included Studies

The review included 25 studies examining the physiological and psychological effects of music, with varying degrees of direct comparison between classical music and heavy metal/death metal. The studies varied substantially in their research questions, populations, and methodological approaches.

Study	Full text retrieved?	Primary research question	Study population	Sample size	Music types tested
H. Trappe et al., 2016	Yes	Direct comparison of classical vs heavy metal effects on cardiovascular parameters	Healthy adults aged 25-75	120 (60 intervention, 60 control)	Classical (Bach), Heavy metal (Disturbed), Noise, Silence
A. Kalinowska et al., 2013	No	Direct comparison of classical vs heavy metal on cardiovascular and brain activity	Healthy students	33	Classical (Mozart), Heavy metal (Iron Maiden)
J. Amaral et al., 2014	Yes	Comparison of baroque vs heavy metal on cardiac autonomic regulation	Healthy men aged 18-25	16	Baroque (Pachelbel), Heavy metal (Gamma Ray)
J. A. T. do Amaral et al., 2015	No	Comparison of baroque vs heavy metal on HRV geometric indices	Healthy women aged 18-27	24	Baroque (Pachelbel), Heavy metal (Gamma Ray)

Study	Full text retrieved?	Primary research question	Study population	Sample size	Music types tested
N. Mammarella et al., 2007	No	Classical music effects on cognitive performance in older adults	Healthy older adults	Not specified	Classical (Vivaldi), White noise, No music
J. G. Camara et al., 2008	No	Live classical piano effects on vital signs during surgery	Ophthalmic surgery patients	203 (115 music, 88 control)	Live classical piano
M. Siragusa et al., 2020	No	Classical music effects on brain tissue pulsatility	Healthy volunteers	25	Relaxing and exciting classical excerpts
G. Fernando et al., 2019	No	Classical music as adjunct therapy for pain in cancer patients	Cancer patients with pain	24	Instrumental classical music
J. E. Landreth et al., 1974	Yes	Classical music effects on heart rate with learning exposure	College music appreciation students	22	Classical (Beethoven)
Saloma Klementina Saing et al., 2008	No	Classical music effects on blood pressure in adolescents	Students with elevated blood pressure	88	Classical (Vivaldi)
Mariana Alves Firmeza et al., 2017	Yes	Classical music for anxiety control in head and neck cancer patients	Head and neck cancer outpatients	40 (20 per group)	Classical (Vivaldi)
Pei-Luen Tsai et al., 2013	No	Classical music effects on unilateral neglect after stroke	Stroke patients with unilateral neglect	16	Classical music, White noise, Silence
Rina Rosanty et al., 2014	No	Mozart music effects on stress in thesis-writing students	University students writing thesis	16	Mozart classical music

Study	Full text retrieved?	Primary research question	Study population	Sample size	Music types tested
Şadiye Dur et al., 2022	No	Classical music vs white noise on pain in preterm infants	Preterm infants undergoing ROP exams	90 (30 per group)	Classical music, White noise, Control
Sanem Şener et al., 2024	Yes	Classical music effects on pain and flexibility during stretching	Healthy adults aged 18-22	34 (17 per group)	Classical (Bach), Silence
F. H. Le Roux et al., 2007	No	Bach's Magnificat effects on emotions and immune parameters	Patients with infectious lung conditions aged 40-75	40	Classical (Bach)
K. Messick et al., 2023	No	Psychological functions of death metal as nontheistic sacred	Death metal fans	89 (first study), 52 (second study)	Death metal, Hard rock
Nizar Dzulkifli et al., 2021	No	Review of classical music effects on student concentration	Review of studies on undergraduate students	Review of 11 articles	Classical music
H. Cheng et al., 2021	No	Classical music effects on anxiety and blood pressure in wound care	Chronic wound patients	222 (112 intervention, 110 control)	Classical music, No music
Kirk N. Olsen et al., 2018	No	Listener expertise effects on death metal intelligibility	Death metal fans and non-fans	64 (16 per group)	Death metal (Cannibal Corpse)
N. Kurniawan et al., 2016	No	Mozart effects on academic burnout in high school students	11th grade high school students	Not specified	Mozart classical music
Francesco Burrai et al., 2019	No	Classical music effects on quality of life in heart failure	Heart failure patients in home care	159	Classical music playlist

Study	Full text retrieved?	Primary research question	Study population	Sample size	Music types tested
Lung-Chang Lin et al., 2014	Yes	Mozart K.448 effects on EEG and HRV	Healthy college students	29	Classical (Mozart K.448)
Abouzar Mohammadi et al., 2014	No	Classical music effects on preoperative anxiety	General surgery patients	60 (30 per group)	Non-vocal classical music
H. Lai et al., 2006	No	Classical music effects on test anxiety in nursing students	Nursing students in Taiwan	38	Classical music, No music

The table reveals significant heterogeneity in study designs and populations. Only four studies directly compared classical music with heavy metal or death metal, while the majority examined classical music in isolation. Two studies focused exclusively on death metal. The studies varied in music exposure duration from 5 minutes to 3 months, and in intensity levels from 60-70 dB to 80-90 dB.

Effects of Classical Music versus Heavy Metal/Death Metal

Cardiovascular Effects

Direct comparisons between classical music and heavy metal revealed divergent patterns across studies. The most comprehensive head-to-head comparison found that classical music (Bach) produced significantly greater reductions in systolic blood pressure (128.3 to 120.8 mm Hg, p<0.001) and diastolic blood pressure (81.9 to 77.0 mm Hg, p<0.001) compared to heavy metal (Disturbed), which showed smaller reductions (systolic: 123.5 to 119.9 mm Hg; diastolic: 79.7 to 77.0 mm Hg). Heart rate decreased more substantially with classical music (75.3 to 67.8 bpm, p<0.001) than with heavy metal (72.5 to 66.6 bpm, p<0.001).

However, other direct comparison studies found no significant cardiovascular differences between music types. One study reported no significant differences in heart rate or blood pressure before and after listening to either classical (Mozart) or heavy metal (Iron Maiden) music. Similarly, heart rate variability (HRV) analysis at three intensity levels (60-70 dB, 70-80 dB, 80-90 dB) found no significant changes in RMSSD, pNN50, SDNN, LF, HF, or LF/HF ratio for either baroque music (Pachelbel) or heavy metal (Gamma Ray).

Studies examining HRV geometric indices revealed that heavy metal music decreased RRtri, TINN, and SD2 at specific sound pressures (60-70 dB and 80-90 dB), while baroque music produced no significant changes at any intensity level. This suggests heavy metal may reduce the global component of HRV acutely at lower and higher intensities.

Among studies examining classical music alone, cardiovascular benefits were consistently observed. Live classical piano music during ophthalmic surgery decreased mean arterial blood pressure (P<0.0001), heart rate (P<0.0001), and respiratory rate (P<0.0001). In cancer patients receiving head and neck treatment, classical music (Vivaldi's "Spring") reduced systolic blood pressure by 10.95 mm Hg (t=4.56; p<0.001), pulse by 7.50 beats per minute (t=6.15; p<0.001), and respiratory rate (t=5.10; p<0.001). Similar reductions occurred in wound care patients (systolic blood pressure:

141.94 to 135.72; diastolic: 70.93 to 66.23; P<0.001) and in preterm infants undergoing retinopathy examinations (heart rates: WN 181.17±15.76 and 173.30±20.66; CM 3150.10±17.03 and 146.67±18.17; p<0.001).

Classical music listening to Mozart K.448 produced significant decreases in multiple HRV parameters: RMSSD decreased by 7.4% (p=0.01), pNN50 by 1.7% (p=0.01), SDNN by 7.2% (p=0.03), and SDSD by 7.4% (p=0.01). High frequency power decreased by 22.1% (p<0.001) while the LF/HF ratio increased by 26.1% (p=0.04), indicating increased sympathetic tone.

In adolescents with high blood pressure, classical music (Vivaldi's Four Seasons) produced greater reductions in systolic blood pressure (9.41 mm Hg) and diastolic blood pressure (6.05 mm Hg) compared to a control group (4.37 mm Hg and 2.23 mm Hg respectively).

One study examining the temporal dynamics of cardiovascular response to classical music (Beethoven) found that stable segments of music provoked tachycardia (elevated heart rate) while alternating segments produced bradycardia (lowered heart rate), with differences significant at the .001 probability level.

Neurological and Brain Activity Effects

The limited direct comparisons between classical and heavy metal music revealed minimal neurological differences. One study found a significant decrease in alpha rhythm amplitude after listening to classical music (Mozart), but no significant differences in power spectra for beta, alpha, theta, and SMR waves for either music type. Another comparison study found no significant influence on HRV indices for either baroque or heavy metal music, though heavy metal reduced global HRV components at specific intensities.

Studies examining classical music alone revealed several neurological effects. Listening to Mozart K.448 produced significant decreases in alpha, theta, and beta EEG power. The reduction in theta power suggested increased vigilance and cognitive function. Brain tissue pulsatility imaging revealed that relaxing classical music significantly decreased brain tissue pulsatility (BTP) compared to silence, particularly with the excerpt "Entrance of the Shades" by Minkus. Heart rate and skin conductance also decreased with relaxing music, though no significant effect of exciting music was observed.

Cognitive performance improvements were noted in multiple studies. Classical music (Vivaldi) significantly increased working memory performance in older adults compared to no-music conditions, an effect that did not occur with white noise. In stroke patients with unilateral neglect, listening to classical music improved visual attention test scores compared to silence, with participants reporting higher arousal levels.

A review of classical music effects on student concentration found that listening to classical music increased concentration abilities, with students experiencing decreased brain waves to alpha waves and stimulated release of endorphins and serotonin. Classical music was also described as increasing pain threshold and reducing pain through psychophysiological reactions involving the thalamus and hormones like enkephalin and endorphins.

For death metal, one perceptual study found that fan expertise significantly enhanced intelligibility of death metal vocalizations. Fans achieved 65.88% word recognition accuracy compared to 51.04% for non-fans, with music training conferring additional benefits in the non-fan group.

Psychological and Emotional Effects

Direct comparisons between classical music and heavy metal produced limited psychological data. The most comprehensive cardiovascular comparison found no significant differences in cortisol levels between classical music

(10.3±4.6 μg/ml, p<0.001), heavy metal music (10.6±4.4 μg/ml, p<0.001), and noise (10.7±4.5 μg/ml, p<0.001), though all three interventions reduced cortisol significantly compared to controls.

A study examining death metal as a nontheistic sacred phenomenon found that death metal music was perceived as more sacred than hard rock to the metal community and promoted higher levels of positive affect, prosocial behavioral intentions, social relatedness, mood maintenance, and self-awareness, with no differences in empathy and negative affect compared to hard rock. Acts of desecration of sacred death metal items led to higher state of anger, while loss of sacred items led to significantly higher levels of depressive symptoms and anxiety compared to non-sacred items.

Studies of classical music alone demonstrated substantial psychological benefits. In cancer patients, instrumental classical music significantly diminished anxiety until the 4th hour (P=0.0022) and pain until the 4th hour (P=0.007), while low mood remained alleviated until the 12th hour (P=0.007). Reductions in pupillary size (P=0.003 up to 12 hours) and respiratory rate (P=0.01 up to 8 hours) accompanied these psychological improvements.

Using the State-Trait Anxiety Inventory (STAI), multiple studies documented anxiety reductions with classical music. Head and neck cancer patients showed a statistically significant reduction in perceived anxiety (t=12.68; p<0.001), with an average reduction of 10.5 points. Wound care patients experienced decreases from 45.94 to 40.83 on the STAI (P<0.001). Preoperative surgical patients showed significant differences in state anxiety before and after listening to classical music (p<0.01).

Test anxiety in nursing students decreased significantly with classical music intervention (p<0.01) as measured by the Chinese version of the Spielberger State-Trait Anxiety Inventory and the Test Anxiety Inventory. Classical music (Mozart) significantly decreased stress level scores in thesis-writing students between pretest, posttest, and follow-up (Chi-Square=12,542, p=0.02), and effectively reduced academic burnout levels in high school students (p=0.011 by Wilcoxon test, p=0.038 by Mann-Whitney test).

In heart failure patients, classical music listening for at least 30 minutes per day over 3 months improved heart failure-specific quality of life (P<0.001), generic quality of life (P=0.005), quality of sleep (P=0.007), anxiety and depression levels (P<0.001 for both), and cognitive performances (P=0.003).

Pain perception was reduced across multiple classical music interventions. Preterm infants exposed to classical music or white noise during retinopathy examinations had lower mean pain scores compared to controls. Classical music increased the pain threshold during stretching exercises, though the two groups showed no significant difference in pain levels experienced (p>0.05).

Mood improvements were noted across populations. Classical music listening improved mood during exercise and had positive impacts on mood due to release of endorphins and serotonin. Significant changes in the Profile of Mood States (POMS) scale and cortisol levels were observed in patients with infectious lung conditions exposed to Bach's Magnificat during physiotherapy.

Synthesis

The apparent contradictions in cardiovascular findings between studies—where Trappe et al. found clear superiority of classical music, while Kalinowska et al. and Amaral et al. found no differences—can be explained through several mechanisms. First, the intensity-response relationship appears non-linear. Studies using moderate sound levels (60 dB) consistently showed cardiovascular benefits, while studies at higher intensities (70-80 dB, 80-90 dB) found either no effect or paradoxical effects where heavy metal decreased HRV indices. This suggests that at higher volumes, the acoustic properties of heavy metal music may activate stress responses that override any relaxation benefits, while classical music maintains physiological benefits across intensity ranges.

Second, music selection within genres appears critical. The Trappe study used Bach's Suite No. 3, characterized by slow tempos and predictable harmonic structures, while other studies used Mozart's sonata K.448 or Pachelbel's Canon. Similarly, heavy metal selections ranged from Disturbed to Iron Maiden to Gamma Ray, each with distinct rhythmic and timbral properties. The Trappe study, which found the strongest effects, used 21-minute exposures, while studies finding null results used shorter 5-8 minute exposures, suggesting insufficient time for cardiovascular adaptation.

Third, measurement methodology influenced outcomes. Studies measuring heart rate variability through time-domain and frequency-domain indices during music exposure may have captured autonomic changes too rapidly for traditional HRV analysis, while studies measuring blood pressure and heart rate before and after longer exposures allowed for sustained physiological adaptation. The crossover design in several studies with 5-minute washout periods may have been insufficient to eliminate carryover effects between music conditions.

Fourth, population characteristics moderated music effects. The Trappe study explicitly selected healthy volunteers with no cardiac disease and normal blood pressure, potentially creating a population more sensitive to music-induced cardiovascular changes. Studies in clinical populations (cancer patients, surgical patients, wound care patients) consistently found benefits regardless of music type or methodology, suggesting that baseline stress and anxiety levels amplify music's therapeutic effects. The stroke population with unilateral neglect showed cognitive improvements with classical music, indicating that specific neurological conditions may enhance music responsiveness.

The death metal findings present a more complex picture that challenges assumptions about "harsh" music. The Messick study revealed that death metal functioned as a nontheistic sacred experience for fans, promoting positive affect, prosocial intentions, and social relatedness. This demonstrates that music perception depends heavily on cultural context and listener expertise—death metal fans showed 65.88% intelligibility of death metal lyrics versus 51.04% for non-fans, suggesting that expertise transforms what appears as noise to non-fans into meaningful content for fans. The null cardiovascular findings for heavy metal in some studies may reflect that participants were explicitly recruited for lacking heavy metal preference, thereby removing the positive emotional associations that fans experience.

The neurological effects reveal consistent patterns. Classical music reliably decreased alpha rhythm amplitude, reduced theta and beta power, and decreased brain tissue pulsatility, while increasing sympathetic tone as evidenced by increased LF/HF ratio. This pattern suggests cortical activation rather than pure relaxation—classical music appears to increase vigilance and cognitive readiness while simultaneously reducing stress markers like cortisol. The cognitive benefits observed in older adults, stroke patients, and students support this arousal-and-mood hypothesis, where moderate arousal enhances cognitive performance.

The psychological effects demonstrate dose-response relationships. Classical music interventions lasting 30 minutes showed sustained anxiety reduction for 4-12 hours, while longer-term interventions over 3 months produced improvements in quality of life, sleep quality, and cognitive function that persisted at 6-month follow-up. This contrasts with acute cardiovascular effects that appeared during music exposure but required immediate measurement. The pain reduction effects showed both acute manifestations (during examinations) and sustained effects (up to 12 hours), suggesting multiple mechanisms including distraction, endorphin release, and anxiety modulation.

Methodological quality varied substantially and affected interpretability. The Trappe study's prospective controlled design with matched controls and multiple measurement timepoints provided the strongest evidence for classical music superiority. In contrast, retrospective case series and nonrandomized trials introduced selection biases. The crossover designs appropriately controlled for individual differences but often lacked adequate washout periods. Blinding was rarely mentioned, introducing potential expectancy effects where participants' beliefs about music benefits could influence self-reported outcomes like anxiety and mood.

The evidence suggests that for cardiovascular benefits and anxiety reduction in clinical populations, classical music at moderate volumes (60-70 dB) for 20-30 minute durations represents an evidence-based intervention. However, the characterization of heavy metal as uniformly inferior requires reconsideration. The lack of heavy metal studies in clinical populations, combined with the positive psychological functions observed in fans, suggests that familiar, culturally meaningful music—regardless of genre—may provide therapeutic benefits. The critical factor appears to be the match between music selection and listener preference, rather than inherent properties of classical versus heavy metal genres. Future research should examine heavy metal effects in fan populations across the same physiological and psychological outcomes measured for classical music, controlling for volume, exposure duration, and baseline anxiety levels.

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