

The Sound of Performance: Exploring the Impact of Music on Athletic Performance and Psychological States

Omer-Meir-Shlomo Cohen ^{a,b}

^a Gaia College, Jerusalem, Israel

^b Varna Free University, Varna, Bulgaria

omer@gaia.college

ABSTRACT: This comprehensive review explores the multifaceted role of music in sports performance psychological well-being. The study synthesizes current research on music's impact across various domains, including athletic performance enhancement, arousal regulation, motivation, resilience, and self-management skills. Drawing from many empirical studies, this paper examines the theoretical underpinnings of music's influence on physical and psychological processes in sports contexts. Key findings underscore the significant potential of music-based interventions to positively affect factors such as perceived exertion, arousal levels, emotional states, and overall performance outcomes. The review also investigates the differential effects of music tempo, familiarity, and personal preference on athletic performance and psychological responses. Furthermore, it delves into the application of music as a management tool for enhancing resilience, motivation, and self-regulation among athletes. This research contributes to the growing knowledge of music's utility in sports psychology and performance management, offering insights for practitioners, coaches, and athletes. The findings suggest that strategically implemented music-based interventions can be a reassuringly cost-effective and accessible means to optimize athletic performance and promote psychological well-being in sports settings.

KEYWORDS: *Music-Based Intervention, Sports Performance Psychology, Psychological Resilience*

Received: 27 December 2024

First revision: 09 January 2025

Accepted: 28 January 2025

1. INTRODUCTION

Music, a powerful force in human experience, has long been acknowledged for its profound impact on exercise and sports. Theoretical frameworks, such as Karageorghis's model of music used in sports (2016), unravel the intricate relationship between musical elements, personal and situational factors, and the resulting psychological and physiological outcomes. By classifying these elements into antecedents, moderators, and consequences, this model underscores the empowering role of music in boosting athletic performance and mental well-being. The present review seeks to integrate two distinct but complementary bodies of literature: research on the Pygmalion effect in workplace settings and studies examining the role of the peace state in human performance. This integration offers insights into how organizations might enhance the effectiveness of expectation-based performance improvement through conscious attention to mental state management.

Empirical evidence underscores the diverse benefits of music in physical activities, from pre-task arousal to emotional regulation during strenuous exercise. Studies have shown that music diminishes the perception of fatigue and enhances strength, endurance, and overall performance (Eliakim et al., 2007; Hutchinson et al., 2018). Moreover, the recognition of personal preferences for specific types of music in influencing athletes' experiences highlights the value of individualized, tailored musical interventions in optimizing training outcomes (Ballmann, 2021).

Moreover, the relationship between music and affective states has been explored in numerous studies, revealing that music can serve as a tool for emotional regulation, enhancing motivation and resilience among athletes (Dingle et al., 2021; Koehler et al., 2023). This research delves into the underlying mechanisms through which music impacts athletic performance and emotional responses, examining various factors such as age, gender, and the nature of physical activities.

This introduction sets the stage for an in-depth investigation into the practical applications of music in sports performance, emotional health, and overall well-being.

2. METODOLOGY

2.1 The Purpose of the Research

The primary aim of this comprehensive research is to rigorously investigate the multifaceted role of music in augmenting athletic performance and promoting emotional well-being within the contexts of exercise and competitive sports. Specifically, this study seeks to:

1. **Examine the Influence of Musical Attributes:** To analyze the effects of various musical factors—including tempo, rhythm, and melodic structure—on athletes' psychological and physiological responses during physical activity.
2. **Explore Individual and Situational Moderators:** To assess the impact of personal characteristics (e.g., age and gender) and situational variables (e.g., context of music exposure) on music's efficacy as a performance enhancement facilitator.
3. **Investigate Emotional Regulation Mechanisms:** To evaluate how music functions as a tool for emotional regulation, influencing motivation, perceived exertion, and resilience among athletes during training and competition.

4. **Assessing the Practical Implications for Music-Based Interventions:** This research provides empirical insights into the application of music as an intervention strategy within training regimens and competitive environments. It thereby optimizes athletic performance and enhances overall psychological well-being, offering tangible benefits for athletes, coaches, and sports psychologists. By addressing these objectives, this research aims to contribute to the existing body of literature on the intersection of music and sport, offering practical recommendations for athletes, coaches, and sports psychologists who seek to leverage music's therapeutic and performance-enhancing properties.

2.2 Research Questions

1. How can personalized music interventions be designed to optimize both physical performance and mental resilience in athletes across different sports?
2. How does the interaction between music tempo, heart rate, and physical exertion affect an athlete's perceived effort and actual performance in various intensity levels of training and competition?
3. To what extent can music-based interventions enhance self-regulation skills in athletes, and how does this translate to improved performance and mental resilience?
4. What is the relationship between an athlete's musical preferences, their personality traits, and the effectiveness of music interventions on their performance and mental resilience?

2.3 Research Approach

This study employs a systematic literature review approach to comprehensively examine existing research on the use of music as a management tool in sports **performance** and mental resilience. By synthesizing findings across various studies, this review aims to identify trends, gaps, and areas for future research.

3. MUSIC AND SPORT THEORY

Karageorghis (2016) published a theoretical model detailing the music use in exercise and sport. The theory is inclusion of feedback loop from the consequences back to the music factors, Karageorghis divide the model into three categories; Antecedents - which are the musical factors, for example, tempo, rhythm, melody, iconic cues etc. Moderators - which are personal and situational factors, for example, age, gender, when music is played, mode of training etc. And consequences - which are the psychological, psychophysical, behavioral and psychophysiological response such as arousal, increased work out, enhanced recovery, flow state etc.

3.1 Music in sport

Evidence suggest that music evoke several benefits in the context of exercise and sport related tasks. For instance, pre task music has been used well as an arousing (Eliakim et al., 2007) or as a relaxant (Karageorghis, 2016). When used while physical activity, music can produce efficient positive states (Hutchinson et al., 2018) and occupy exercisers or athletes from the unpleasant emotions linked

with physical effort and fatigue. These effects contain heightened strength and power output (Karageorghis, 2016), expanded stamina (Terry et al., 2012), and enhanced work rate (Lee & Kimmerly, 2016). physical performance improvement has been reported both when participants have synchronized their own movements with music (Terry et al., 2012) and in the lack of synchronization (Hutchinson et al., 2018). In addition, evidence suggests that personal choice is an important aspect to increasing performance with music compared to not preferred the music that plays over the speakers in large places such gym, soccer field, and more, performance may suffer (Ballmann 2021).

Athletes nowadays may use music, to feel stimulated, to feel relaxed or to create a particular pre-competition mindset (Karageorghis, 2016). In addition, organizers of sporting events apply music to produce an atmosphere of patriotism, excitement, or tension among fans (Tubino, de Souza, & Valladão, 2009). Many people intuitively believe that music can benefit in the physical activity territory. The main effects of music in physical activity contexts are relying upon a wide spectrum of musical, personal, and situational variables. Such variables contain gender and age (Clark, Taylor, & Baker, 2012), familiarity with music (Elvers & Steffens, 2017), preference for a certain type of music (Hutchinson et al., 2018), music tempo (Van Dyck et al., 2015), intensity of the physical activity participant training status (Carlier & Delevoeye-Turrell, 2017), and the type of the physical activity (Karageorghis, 2016).

Maddigan and colleagues (2019) examined in their study the effects of music about high-intensity activities. They used 130 bpm music tempo during repeated high intensity cycling bouts. 8 male and 8 female took part in the study. The researchers measured rating of perceived exertion, breathing frequency, heart rate, blood lactate, ventilatory kinetics and time to exercise endpoint. Their findings showed that with 130 bpm music tempo participants exercised longer, had higher heart rate and higher breathing frequency than the participants without music condition. More than that, the results strengthen the notion that music can contribute to prolonged exercise durations at higher intensities.

Another interesting research about music tempo, synchronized music and sport performance can be found in Williams and colleagues (2020) research, which examined the role of the correlation between music tempo and athlete's heart rate to improving athlete's performance with the help of generative music system. 54 runners took part in the study, and the results showed that music which was synchronous with the runner's heart rate or steps per minute improved performance and significantly reduced perceived effort.

Jebabli and colleagues (2023) reinforce Williams's statement by investigating the effect of listening to preferred music and different types of endpoint knowledge on repeated countermovement jump test performance. The results from the study showed that preferred music provided a positive enhancement on the feeling scale among basketball players. Plus, preferred music affected performance jump height, contact time, and flight time during repeated countermovement jump.

About perception of fatigue, Wu and colleagues (2022) in their research investigated the subjective and objective fatigue perception about runners who listen to music with different kind of tempo. In the research participated eighteen people which they did 108 sets of running experiments. The results showed that fast music can reduce the perception of fatigue of runners.

Psychological flexibility plays a critical role in adapting to challenging situations and enhancing overall well-being. As Fuchs and Fuchs (2023), interventions aimed at improving self-regulation and emotional resilience are highly effective in fostering higher levels of quality of life. Similarly, music-based interventions act as facilitators of psychological flexibility, helping athletes manage stress and improve performance during intense physical activity. Recent research has highlighted music's impact on physiological flexibility and physiological well-being. Javaid and colleagues (2024) also found that music plays a crucial role in psychological well-being, with 78% of participants identifying it as essential for daily functioning. Music was shown to provide emotional comfort, cognitive distraction, and stress relief, while also enhancing memory, learning, and social cohesion. Chakravarty and colleagues (2022), in a systematic review of 18 studies (1,151 participants), examined music's effect on oxy-gen saturation

during medical interventions. They found that Western classical music was most effective, especially in ICU settings, and live music improved oxygen saturation in terminally ill patients. Louis (2024) explored how different music genres affect exercise performance and found that classical music maximized enjoyment and motivation, followed by pop, while rock music led to lower satisfaction. These findings suggest that musical genre selection significantly moderates exercise enjoyment, with classical music demonstrating optimal potential for enhancing mood and motivation during physical activity.

3.2 Music, Emotions and Affects

It is known that there is correlation between music and emotions. Lundqvist and colleagues (2009) provides in their research some key points about the saying above. They measured self-reported emotion, autonomic activity, and facial muscle activity, in 32 participants. The participated listened to music composed with both happy and a sad emotional expression. They found in the research that cheerful music induced greater feelings of happiness, and the same goes to sad music which induced greater feelings of sadness.

It is common that athletes use music consciously or unconsciously to control of psychomotor arousal, regulate affective state and stimulate specific emotions such as happiness, liveliness, calmness, or aggression (Terry et al., 2020). Additionally, music decreases athletes' anxiety, depression, and pain management, it's clear to say that music as a treatment can be inexpensive action that has no negative side effects (Kuan 2023).

In high-intensity training, significant levels of arousal are desirable. In these situations, the potential of the musical stimulus to arouse the athletes becomes of seminal importance (Chanda & Levitin, 2013).

Bacon and colleagues (2012) were examined if there is improvement in the exercise when movements are synchronized with musical beat, 30 Caucasian males, aged 18-25 years participated in the study and selected their three favorite music types, the music was altered to play at 123, 130, or 137 beats per minute. The findings suggest that exercising synchronously with music enhances efficiency compared to performing exercises with music playing at a slightly slower tempo than the cyclical movement rate.

McPherson and colleagues (2019) investigated the ability of active Music Therapy and passive Music Therapy interventions to regulate physiological markers in healthy adults. The interventions that the researchers did were designed with the goal of reducing physiological arousal and stress. The results showed that the presence of rhythmic movement with music changed the way the sympathetic Autonomic Nervous System responds to rhythm-based music therapy interventions.

Another research about music and arousal which done in Finland and examined the range of experiences by listening to sad music. They tested 102 participants by self-reports. They provide evidence that unfamiliar, instrumental sad music evokes strong emotional such as peacefulness and positive valence. Furthermore, they showed that listening to the sad and unfamiliar music lead to increased emotional arousal and relaxation (Eerola, Vuoskoski & Kautiainen. 2016).

The use of music in other sports is substantial, Gabana and colleagues (2019) investigated current music use specific among golfers using a qualitative approach. Ten golfers were included in the study. While the purpose of the study was to gain a better understanding of music in golfers, the researchers using a semi-structured inter-view guide asked two main questions about the use of music in golfers. The results indicate that golfers found music to be a performance enhancer in different ways as increased effort and improved mood. Further, all the golfers stated that listening to music while golfing praised regulate both their energy and arousal associated to mental performance state.

Chen and colleagues (2022), compared in their study both physical and psychological responses of male and female basketball players with asynchronous, synchronous, and no music while sprinting and doing technical tasks. 13 men and 10 women participated in the study which all of them were high level athletes and were randomly divided into two groups. Both groups did exercises tasks such as sprints and basket-ball shots, but one group was without music intervention and the other group was with interactive music intervention. The results from the study showed that basketball players listening to synchronous music have raised arousal and decreased rating of perceived exertion than asynchronous music and no music while exercise tasks.

3.3 Intervention Effects through Listening to Music

The Effect of a Music-based Intervention on and Self-regulation Skills. Con-texts involving music have the potential to elicit self-regulatory mechanisms, encompassing the adaptation of cognitive processes, emotional states, and behavioral responses, thereby exerting influence on mental well-being (Dingle et al., 2021). The integration of cognitive-behavioral principles into educational settings has shown success in fostering self-management skills among young children (Fuchs & Fuchs, 2023). In sports, similar principles can be applied using music as a cognitive tool to enhance athletes' ability to regulate their effort, focus, and emotional state during training and competition.

Research findings indicate that music facilitates synchronization between distinct cortical regions of the brain, notably the right and left hemispheres, eliciting heightened emotional response, enhanced attentional focus, and increase motivational tendencies (Davies, 2000). Plus, the universal appeal of music underscores its capacity to engender transformative learning experiences among adult learners (Olson, 2005).

Utilizing music-based communication modalities has been shown to augment the processes of learning, retention, and recall, thereby enhancing the overall efficacy of information assimilation and retention (Davies, 2000). Holstad and colleagues (2013) in their research developed a music program that increased levels of adherence self-efficacy, decrease viral loads and promoted self-management by audio music program that educate and motivate persons living with HIV. About self-regulation skills, mu-sic therapy offers evidence that rhythm engagement can benefit self-regulation (Thaut et al., 2009). Music therapists apply beat synchronization and rhythmic auditory cueing to enhance cognitive and motor functions in brain-injured patients (ibid.), along correlation for rhythmic auditory stimulation and motor rehabilitation (Thaut & Abiru, 2010).

The Effect of a Music-Based Intervention on Resilience. Limited understanding exists regarding its association with resilience, as prior investigations have primarily focused on individual resilience factors, such as emotion regulation or self-efficacy, as evidenced by the scant empirical research (e.g., Saarikallio, Randall, & Baltazar, 2020). A recent theoretical synthesis posited that involvement in music may bolster resilience by enhancing factors such as the construction of meaning, interpersonal connections, and personal agency (Nijs & Nicolaou, 2021).

Given that a significant portion of individuals partake in musical activities during their leisure hours, the act of engaging with music holds promise for nurturing resilience attributes, thereby contributing to resilient outcomes. Numerous studies examining music consumption patterns have demonstrated favorable correlations with mental well-being (Bradshaw, Ellison, Fang & Mueller, 2014). Fancourt and colleagues (2016) study explored whether a music-making intervention could improve mental health such as resilience. The result from the study demonstrates that drumming group interventions can reduce depression and anxiety plus improve social resilience in participants with mental health struggles.

Koehler and colleagues (2023) provided insights of how resilience associated with too passive and active music engagement. With help of 511 participants that completed an online survey on resilient

and music they found from the results that the more time the participants spend on making and listening to music they have better stressor recovery ability and slighter mental health problems.

The Effect of a Music-Based Intervention on Motivation. Meglic and colleagues (2021) investigated in their study the effect of preferred music and not preferred music while warm-up on anaerobic sprint ability, rate of perceived exertion and motivation to exercise. 14 female collegiate athletes participated in the correct study. The results showed that listening to preferred music while warm-up increases power output, motivation to exercise versus non-preferred music. Although, the results supported that the rate of perceived exertion remained unchanged between conditions.

Additionally, Rogers and colleagues (2023) explored the influences of preferred music and non-preferred music on countermovement jump performance and psychological responses to music during movements in active females. The findings from the study showed that listening to preferred music produced superior performance in physically active while maximal isometric testing. Moreover, measures of feeling psyched up and motivation were heightened which can influence changes in performance.

Another interesting music and motivation correlation is from Nixon and colleagues (2022), which investigated in their study the role of preferred and non-preferred music volume on a 2000-m rowing time trial. 12 physically active females participated in this study. The findings from the study showed that preferred music volume did not have any change on the exercise performance compared to non-preferred music volume. However, preferred music volume increased motivation and decreased the rate of perceived exertion.

The Effect of a Music-Based Intervention on Arousal. According to Dube and Lebel (2003), music consistently occupies a position within the upper echelons of things that highly esteemed for their capacity to evoke pleasure, often ranking within the top ten. One prevailing hypothesis is that music exerts its impact by modulating emotional states. This line of reasoning suggests that music may evoke or enhance emotions, thereby implicating emotion as a potentially rewarding phenomenon (Huron, 2006).

Chen and colleagues (2022), compared in their study both physical and psychological responses of male and female basketball players with asynchronous, synchronous, and no music while sprinting and doing technical tasks. 13 men and 10 women participated in the study which all of them were high level athletes and were randomly divided into two groups. Both groups did exercises tasks such as sprints and basket-ball shots, but one group was without music intervention and the other group was with interactive music intervention. The results from the study showed that basketball players listening to synchronous music have raised arousal and decreased rating of perceived exertion than asynchronous music and no music while exercise tasks.

In a study done in Finland the researchers examined the range of experiences by listening to sad music. They tested 102 participators by self-reports. They provide evidence that unfamiliar, instrumental sad music evokes strong emotional such as peace-fulness and positive valence. Furthermore, they showed that listening to the sad and unfamiliar music lead to increased emotional arousal and relaxation (Kautiainen, 2016).

Kuan and colleagues (2018) investigated the effects of unfamiliar and arousing music while imagery training on dart-throwing performance. In the study participants were 63 novice dart throwers both males and females and were randomly assigned to unfamiliar arousing music group, unfamiliar relaxing music group, and no music group. The findings of the study showed that listening to unfamiliar relaxing music accompanied imagery training enhance performance of a fine motor skill. Likewise, relaxing music was associated with the largest reductions in arousal in time the arousing music was associated with the lowest reductions in arousal.

More about music and arousal was investigated by Kuan and colleagues (2017). In this study the researchers investigated effects of classical arousing and relaxing music on perceptions of arousal and physiological indicators during imagery of a sport task. 12 shooters took part in the study. The results

showed that relaxing music was the most relaxing to the physiological measures and unfamiliar arousing music was the most arousing to the physiological measures.

4. RESULTS

The results revealed several significant findings regarding the influence of music on both sports performance and psychological well-being. Research by Maddigan and colleagues (2019) demonstrated that music with a tempo of 130 bpm extended exercise duration, increased heart rates, and raised breathing frequency, suggesting that music enhances performance during high-intensity exercise. Jebabli and colleagues (2023) found that preferred music positively affected basketball players, improving jump height, contact time, and flight time while also enhancing overall well-being. Williams and colleagues (2020) showed that music synchronized with runners' heart rates improved performance, and Wu and colleagues (2022) indicated that fast-tempo music reduced the perception of fatigue during running. Lundqvist and colleagues (2009) observed that cheerful music induced happiness, while sad music led to sadness, with measurable autonomic and facial responses, highlighting music's emotional impact.

Chen and colleagues (2022) found that synchronous music increased arousal and decreased perceived exertion in basketball players, while Eerola, Vuoskoski, and Kautiainen (2016) revealed that instrumental sad music evoked emotional arousal and relaxation. In sports-specific contexts, Gabana and colleagues (2019) reported that golfers used music to regulate energy and arousal, leading to improved mood and performance, and Chen and colleagues (2022) found that synchronous music enhanced basketball performance across both male and female athletes. Music preference also played a role, with Meglic and colleagues (2021) showing that preferred music during warm-up increased power output and motivation, while Nixon and colleagues (2022) found that higher volumes of preferred music reduced perceived exertion but did not significantly impact performance.

Koehler and colleagues (2023) noted that greater engagement with music improved stress recovery and reduced mental health issues, with Fancourt and colleagues (2016) demonstrating that group drumming interventions reduced depression and anxiety while fostering social resilience. Finally, Bacon and colleagues (2012) established that synchronized music improved exercise efficiency, and McPherson and colleagues (2019) found that rhythmic movement to music influenced sympathetic nervous system responses, with different effects seen between active and passive music interventions. Collectively, these findings underscore the positive impact of music on both physical performance and psychological well-being, highlighting its role in endurance, emotion regulation, and mental resilience.

5. DISCUSSION

This research has elucidated the multifaceted role of music as an intervention tool in enhancing athletic performance and mental resilience. The findings collectively underscore the significance of music in shaping both the physical and psychological experiences of athletes, suggesting a complex interplay that warrants further exploration.

The application of Karageorghis's (2016) theoretical model, which delineates the relationship between music factors, personal and situational moderators, and the consequential psychological and physical responses, provides a robust framework for understanding the efficacy of music in sports contexts. This model illustrates how antecedent factors, such as tempo and genre, interact with individual differences—like personality traits and training status—to influence performance outcomes.

For in-stance, studies indicating that preferred music can enhance performance more than non-preferred music (Ballmann, 2021) suggest that personal relevance plays a crucial role in the motivational effects of music. This finding aligns with the notion that individual differences must be considered when designing music interventions.

The review also highlights the psychological mechanisms by which music impacts athletic performance. Research indicates that music serves as a powerful emotional regulator, capable of modulating arousal and mood states (Terry et al., 2020). The ability of music to evoke specific emotional responses, as demonstrated by Lundqvist and colleagues (2009), suggests that athletes can strategically select music to induce desired psychological states, whether that be heightened excitement or calm focus. This capacity for self-regulation through music is particularly relevant in high-pressure competitive environments, where emotional control is paramount.

Additionally, the relationship between music and perceived exertion is noteworthy. Studies by Maddigan and colleagues (2019) and Wu and colleagues (2022) demonstrate that music can effectively reduce the perception of effort, allowing athletes to engage in prolonged physical activity at higher intensities. The psychological perception of effort plays a crucial role in athletic performance. Fuchs and colleagues (2023) explore the cognitive biases influencing perceived effort, demonstrating how interventions can recalibrate these perceptions. Similarly, music can act as a psychological tool, reducing perceived exertion and enabling athletes to sustain higher levels of performance. This reduction in perceived exertion not only enhances performance but also has implications for training strategies, suggesting that incorporating music into workout sessions may facilitate greater adherence and overall training volume.

The social and cultural dimensions of music in sports also merit consideration. Music's role extends beyond individual experiences, impacting cultural and social dynamics. According to Fuchs and colleagues (2023) "quasi organic society" and Gabana et al. (2019), music fosters a collective sense of identity and cohesion. In team sports, this shared musical experience can enhance group motivation, strengthen bonds, and contribute to overall performance improvements." In team sports, the shared experience of music can foster a sense of unity and motivation among athletes. Understanding how music can be used to create a motivating atmosphere in team settings may provide valuable insights for coaches and sports organizations.

Furthermore, the implications of music consumption patterns in diverse cultural contexts raise questions about the universality of music's effects. Research has shown that cultural differences influence musical preferences and emotional responses (Nijs & Nicolaou, 2021). Future studies should explore how cultural backgrounds impact the effectiveness of music interventions, as tailoring interventions to align with athletes' cultural contexts could enhance their efficacy.

6. LIMITATIONS AND FUTURE RESEARCH DIRECTION

Despite the compelling insights presented in this research, several limitations warrant attention. The predominance of studies focused on specific populations—often predominantly male athletes in certain sports—limits the generalizability of findings. More research is needed that includes a diverse array of sports, genders, and age groups to better understand the breadth of music's impact on performance and resilience.

Moreover, while self-reported measures are prevalent in the existing literature, they may be subject to biases that affect the validity of findings. Future research should prioritize the inclusion of objective performance metrics alongside subjective assessments to provide a more comprehensive understanding of music's effects.

In addition, investigating the neurophysiological mechanisms underlying music's impact on athletic performance could illuminate why and how music induces specific psychological states. Exploring the

brain's responses to different musical stimuli may provide insights into optimizing music interventions based on individual neurological profiles.

7. CONCLUSION

This research has provided a comprehensive examination of the role of music as an intervention tool in enhancing sports performance and mental resilience among athletes. The findings highlight that music serves not only as a motivational enhancer but also as a significant psychological regulator, influencing emotions, perceived exertion, and overall athletic experience.

The research underscores the importance of personalized music interventions that consider individual preferences, cultural contexts, and situational factors. Studies demonstrate that athletes who engage with preferred music exhibit improved performance and reduced perceptions of effort, suggesting that music can be tailored to maximize its effectiveness based on individual differences. Furthermore, the emotional and social dimensions of music indicate its potential to foster team cohesion and enhance the communal experience of sport.

Despite the promising findings, several gaps remain in the current literature, including a need for more diverse populations in research and a deeper exploration of the neurophysiological mechanisms behind music's effects. Future studies should aim to address these limitations, paving the way for more inclusive and comprehensive understandings of music's impact on athletic performance.

In conclusion, the integration of music into athletic training and performance not only enhances physical capabilities but also plays a critical role in promoting psychological well-being and resilience. As research in this area progresses, interdisciplinary collaboration among sports scientists, psychologists, and music therapists will be essential in harnessing the full potential of music as a performance-enhancing tool. Understanding the nuanced interactions between music, emotion, and performance will ultimately pave the way for innovative strategies that can benefit athletes at all levels.

REFERENCES

- Bacon, C.J., Myers, T.R. & Karageorghis, C.I. (2012). Effect of music-movement synchrony on exercise oxygen consumption. *Journal of Sports Medicine and Physical Fitness*, 52(4), 359-365.
- Ballmann, C. G. (2021). The influence of music preference on exercise responses and performance: A review. *Journal of Functional Morphology and Kinesiology* 6(2), 33.
- Bradshaw, M., Ellison, C. G., Fang, Q., Mueller, C. (2014). Listening to religious music and mental health in later life. *The Gerontologist* 55(6), 961–971.
- Carlier, M., Delevoeye-Turrell, Y., Fun2move consortium. (2017). Tolerance to exercise intensity modulates pleasure when exercising in music: The upsides of acoustic energy for high tolerant individuals. *PLoS ONE* 12.
- Chakravarty, R., Mehta, N., & Vir, D. (2022). Effect of Music Therapy on Oxygen Saturation Level: A Literature Review. *Harmonia: Journal of Arts Research and Education*, 22 (1), 37-47.
- Chanda, M. L., Levitin, D. J. (2013). *The neurochemistry of music*. *Trends in Cognitive Sciences* 17, 179–193.
- Chen, C. C., Chen, Y., Tang, L. C., Chieng, W. H. (2022). Effects of interactive music tempo with heart rate feedback on physio-psychological responses of basketball players. *International Journal of Environmental Research and Public Health* 19(8), 4810.

- Clark, I. N., Taylor, N. F., Baker, F.: Music interventions and physical activity in older adults: A systematic literature review and meta-analysis. *Journal of Rehabilitation Medicine* 44, 710–719 (2012).
- Davies, M. (2000). Learning. The beat goes on. *Child Educ.* 76(3), 148–153.
- Dingle, G. A., Sharman, L. S., Bauer, Z., Beckman, E., Broughton, M., Bunzli, E., et al. (2021). How do music activities affect health and well-being? A scoping review of studies examining psychosocial mechanisms. *Frontiers in Psychology* 12, 713818.
- Dubé, L., Le Bel, J. (2003). The content and structure of laypeople's concept of pleasure. *Cognition & Emotion* 17(2), 263–295.
- Eerola, T., Vuoskoski, J. K., Kautiainen, H.: Being moved by unfamiliar sad music is associated with high empathy. *Frontiers in Psychology* 7, 1176 (2016).
- Eliakim, M., Meckel, Y., Nemet, D., Eliakim, A. (2007). The effect of music during warm-up on consecutive anaerobic performance in elite adolescent volleyball players. *International Journal of Sports Medicine* 28, 321–325.
- Elvers, P., Steffens, J. (2017) The sound of success: Investigating cognitive and behavioral effects of motivational music in sports. *Frontiers in Psychology* 8, 2026.
- Fancourt, D., Perkins, R., Ascenso, S., Carvalho, L. A., Steptoe, A., Willamson, A.: Effects of group drumming interventions on anxiety, depression, social resilience and inflammatory immune response among mental health service users. *PLoS ONE* 11(3), e0151136 (2016).
- Fuchs, H., & Fuchs, A. (2023a). Psychological Flexibility and Higher Levels of Quality of Life. *Quality Research*, 14, 2147–2148.
- Fuchs, A., Fuchs, H., & Benkova, E. (2023). The Quasi-Organic Society Living Culture Body and Its Business Applications. in *Entrepreneurship and the Economy in an Era of Uncertainty*. Prerov University Press.
- Fuchs, H., & Fuchs, A. (2023b). The Effects of Classroom Management-Based CBT on the Development of Self-Management Skills in Young Children. *Economics, Management & Business*, 8, 1056–1065.
- Fuchs, A., H. Fuchs, & E. Roffe. (2023). Small Amount Fallacy – Its Psychological Causes, Their Cumulative Destructive Effect, and the Mathematical Solution. *Economics, Management & Business*, 8, 1047–1055.
- Gabana, N. T., Hutchinson, J., Beauchemin, J., Powless, M., Cawthra, J., Halterman, A., Steinfeldt, J. (2019). A qualitative investigation of music use among amateur and semi-professional golfers. *Sports (Basel, Switzerland)* 7(3), 60.
- Holstad, M. M., Ofotokun, I., Higgins, M., Logwood, S. (2013). The LIVE Network: a music-based messaging program to promote ART adherence self-management. *AIDS and Behavior* 17(9), 2954–2962.
- Hutchinson, J. C., Jones, L., Vitti, S. N., Moore, A., Dalton, P. C., O'Neill, B. J. (2018). The influence of self-selected music on affect-regulated exercise intensity and re-membered pleasure during treadmill running. *Sport, Exercise, and Performance Psychology* 7, 80–92.
- Javaid, Z, K., Akram, D., Fatima, S, M., Ahmad, J., & Hafeez, H. (2024). Investigating Emotional Experiences of Music Listener: Impact on Psychological Well-being. *Harf-O-Sukhan*, 8(2), 494-501.
- Jebabli, N., Khelifi, M., Ouerghi, N., Boujabli, M., Bouassida, A., Abderrahman, A. B., van den Tillaar, R. (2023). Single and combined effects of preferred music and end-point knowledge on jump performance in basketball players. *Sports (Basel, Switzerland)* 11(5), 105.
- Karageorghis, C. I. (2016). The scientific application of music in exercise and sport: To-towards a new theoretical model. In: Lane, A. M. (ed.) *Sport and Exercise Psychology*, 2nd edn., pp. 274–320. Taylor & Francis.

Koehler, F., Schäfer, S. K., Lieb, K., Wessa, M. (2023). Differential associations of lei-sure music engagement with resilience: A network analysis. *International Journal of Clinical and Health Psychology* 23(3), 100377.

Kuan, G. (2023). The effect of music listening on athletes' anxiety, depression, and pain: A mini review. *The Asian Journal of Kinesiology* 25, 19-25.

Kuan, G., Morris, T., Kueh, Y. C., Terry, P. C. (2018). Effects of relaxing and arousing music during imagery training on dart-throwing performance, physiological arousal indices, and competitive state anxiety. *Frontiers in Psychology* 9(14).

Kuan, G., Morris, T., Terry, P. (2017). Effects of music on arousal during imagery in elite shooters: A pilot study. *PLoS ONE* 12(4).

Lee, S., Kimmerly, D. S. (2016). Influence of music on maximal self-paced running performance and passive post-exercise recovery rate. *The Journal of Sports Medicine and Physical Fitness* 56, 39–48 (2016).

Louis, K. (2016). Effects of Different Types of Music on Exercise Performance and Enjoyment among College Students in Germany. *International Journal of Physical Education, Recreation and Sports*, 2(1), 1–12.

Lundqvist, L.-O., Carlsson, F., Hilmersson, P., Juslin, P. N. (2009). Emotional responses to music: Experience, expression, and physiology. *Psychology of Music* 37(1), 61–90.

Maddigan, M. E., Sullivan, K. M., Halperin, I., Basset, F. A., Behm, D. G. (2019). High tempo music prolongs high intensity exercise. *PeerJ* 6, e6164.

McPherson, T., Berger, D., Alagapan, S., Fröhlich, F. (2019). Active and passive rhythmic music therapy interventions differentially modulate sympathetic autonomic nervous system activity. *Journal of Music Therapy* 56(3), 240–264.

Meglic, C. E., Orman, C. M., Rogers, R. R., Williams, T. D., Ballmann, C. G. (2021). Influence of warm-up music preference on anaerobic exercise performance in Division I NCAA female athletes. *Journal of Functional Morphology and Kinesiology* 6(3), 64.

Nijs, L., Nicolaou, G. (2021). Flourishing in resonance: Joint resilience building through music and motion. *Frontiers in Psychology* 12, 666702.

Nixon, K. M., Parker, M. G., Elwell, C. C., Pemberton, A. L., Rogers, R. R., Ballmann, C. G. (2022). Effects of music volume preference on endurance exercise performance. *Journal of Functional Morphology and Kinesiology* 7(2), 35.

Olson, K. (2005). Music for community education and emancipatory learning. *New Directions for Adult and Continuing Education* 107, 55–64.

Rogers, R. R., Williams, T. D., Nester, E. B., Owens, G. M., Ballmann, C. G. (2023). The influence of music preference on countermovement jump and maximal isometric performance in active females. *Journal of Functional Morphology and Kinesiology* 8(1), 34.

Saarikallio, S., Randall, W. M., Baltazar, M. (2020). Music listening for supporting adolescents' sense of agency in daily life. *Frontiers in Psychology* 10, 2911.

Terry, P. C., Karageorghis, C. I., Curran, M. L., Martin, O. V., Parsons-Smith, R. L. (2020). Effects of music in exercise and sport: A meta-analytic review. *Psychological Bulletin* 146(2), 91–117.

Terry, P. C., Karageorghis, C. I., Saha, A. M., D'Auria, S. (2012). Effects of synchro-nous music on treadmill running among elite triathletes. *Journal of Science and Medicine in Sport* 15(1), 52–57.

Thaut, M. H., Abiru, M. (2010). Rhythmic auditory stimulation in rehabilitation of movement disorders: A review of current research. *Music Perception* 27(4), 263–269.

Thaut, M., Gardiner, J. C., Holmberg, D., Horwitz, J., Kent, L., Andrews, G., McIntosh, G. R. (2009). Neurologic music therapy improves executive function and emotional adjustment in traumatic brain injury rehabilitation. *Annals of the New York Academy of Sciences* 1169, 406–416.

Thaut, M. H., Stephan, K. M., Wunderlick, G., Schicks, W., Tellmann, L., Herzog, H., McIntosh, G. C., Seitz, R. J., Homberg, V. (2009). Distinct cortico-cerebellar activations in rhythmic auditory motor synchronization. *Cortex* 45, 44–53.

Tubino, M. J. G., de Souza, B. C., Valladão, R. (2009). An analysis about the contents of the officials and popular anthems of the main soccer teams of the city of Rio de Janeiro from the Primeira República to the Estado Novo. *Fitness & Performance Journal* 8, 56–67.

Van Dyck, E., Moens, B., Buhmann, J., Demey, M., Coorevits, E., Dalla Bella, S., Leman, M. (2015). Spontaneous entrainment of running cadence to music tempo. *Sports Medicine* 1, 15.

Williams, D., Fazenda, B., Williamson, V., Fazekas, G. (2020). *On performance and perceived effort in trail runners using sensor control to generate bisynchronous music*. *Sensors* (Basel, Switzerland) 20(16), 4528.

Wu, J., Zhang, L., Yang, H., Lu, C., Jiang, L., Chen, Y. (2022). The effect of music tempo on fatigue perception at different exercise intensities. *International Journal of Environmental Research and Public Health* 19(7), 3869.