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Psychological Effects Of Music On Physical Exercise Performance

Wang Jiangang[1]

[1]Kangwon National University Doctoral Student, Graduate school of convergence, Kangwon National University Chuncheon Campus, 1 Kangwondaehakgil, Chuncheon-Si, Gangwon State, 24341 Republic Of Korea.

Email ID: wjiangang69@gmail.com

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ABSTRACT

Introduction: Over the years, music has been used as a motivating factor by human beings across different environments such as when working, having a good time, celebrating occasions, honoring soldiers, motivating and encouraging individuals, inspiring, and giving them the strength to continue [1]. This shows that the positive impact of music on individuals in sports and exercises has continued to attract more interest in research.

Objectives: The objective of this study was to analyze the psychological effects of music on physical exercise. Other objectives include; to find out the general exercise response to aerobics while listening to music, to understand the psychological effects of music on physical exercises, to find out the physiological impact of music on an individual while doing aerobics and to find out the psychological effects of anaerobic and sprint.

Methods: The methodology applied on the study is literature review where several researched articles on music and aerobics or physical performance were analyzed and discussed. The selection criteria included articles published in English and article that were not older than 5 years.

Results: The study results indicated that music listening during exercise and sport can yield substantial positive effects for exercisers and athletes, particularly regarding enhanced emotional responses and improved physical performance, as well as reduced perceived exertion and more efficient oxygen utilization. Such repercussions are not necessarily inevitable.

Conclusion: The study concludes that music can enhance both physiological efficiency and physical performance, which could be significantly beneficial for both individual and professional athletes engaged in activities where the distinctions between success and failure are exceedingly narrow.

Keywords: *Lorem, ipsum, dolor, sit*

1. INTRODUCTION

Over the years, music has been used as a motivating factor by human beings across different environments such as when working, having a good time, celebrating occasions, honoring soldiers, motivating and encouraging individuals, inspiring, and giving them the strength to continue [1]. This shows that the positive impact of music on individuals in sports and exercises has continued to attract more interest in research. The main area of interest looks at the physiology of music that increases the neuromuscular fatigue threshold of the quadriceps femoral muscles about the incremental sing-leg knee extensors [1]. In addition, the blood lactate concentrations in addition to the consumption of oxygen were also lower with music that was played for submaximal running. Some studies have shown that music can reduce obese and overweight women due to their perceived exertion during self-selected spacewalking [2]. Also regarding music and physical performance, music has the potential to increase total work, peak power output, relative peak power output, and mean power output as per the Wingate anaerobic tests [3]. Time-to-exhaustion will be longer when running while people are listening to music.

Also when it comes to the psychological effects of music, it is said that music can promote a positive impact during aerobic exercises. There is, however, a need to ensure that the underlying mechanism is systematically explored [3]. Current studies on the impact of music on physical exercise have shown that there is a limitation on the capacity of afferent neurons which also means that there is a continuous and dynamic competition between the internal and external information of the body and the brain processing. When looking at the external surroundings, it is evident that music has the potential to inhibit the perception of an individual regarding psychological feedback signals that are also related to physical exertion, which to some extent is going to shield against the issue of fatigue [4]. When an individual begins to exercise, they often focus on their external environment.

Music has been a crucial element of human culture and evolution, potentially predating vocal communication. It permeates every community on Earth, from the most rudimentary to the most advanced, in diverse forms [5]. Music punctuates our daily existence and accompanies a diverse array of activities: it is essential to initiation ceremonies, weddings, and funerals; mothers instinctively employ it to soothe a restless child; it invigorates soldiers preparing for battle and facilitates the coordination of their advance; our most intimate moments are intensified by its presence; and it permeates numerous facets of exercise and sport. Music is so essential to the human experience that German philosopher Friedrich Nietzsche famously asserted, “Without music, life would be a mistake”. The intensity of physical exercise is seen as a crucial factor influencing the effect and is appropriately treated as a moderating variable in this study. Ekkekakis' dual-mode theory offers a paradigm that delineates the affective effects of three qualitatively distinct levels of physical activity intensity [6]. Moderate physical exercise, defined as below the ventilatory threshold (the point at which respiration becomes strenuous), is typically enjoyable. Intense physical exertion, approaching the ventilatory threshold, may be experienced as either enjoyable or unenjoyable based on the individual's perspective. Intense physical exertion, beyond the ventilatory threshold, is generally seen as unpleasant.

Due to its ability to improve emotional states during exercise, music has been recommended as a method to boost adherence to physical activity. The function of music may be particularly advantageous, since it has demonstrated a favorable impact on affective valence, even under elevated levels of physical exercise intensity [7]. Consequently, music may mitigate the adverse emotional responses commonly linked to intense physical exertion or transform perceptions of strenuous exercise into a joyful experience. From a behavioral modification standpoint, music may establish connections between physical exercise and good emotions that affect subsequent decision-making processes.

In affluent nations, where most individuals are not involved in manual labor, a deficiency of enjoyment is often identified as an obstacle to engaging in physical activity. The pervasive and culturally influential role of music in physical activity is attributed to its ability to enhance emotional states and enjoyment [7]. The emotional attributes of music have prompted researchers to propose that it contributes to improving adherence to physical activity and outcomes in both ostensibly healthy individuals and those engaged in rehabilitative exercise programs. The phrase physical activity encompasses a wide range of actions that have a physical element yet are otherwise distinct. These behaviors encompass participation in highly regulated activities within the sports realm, organized exercise, or dance classes, as well as more informal physical pursuits like walking, household chores, gardening, and manual labor [8]. This inquiry is confined to two distinct domains of physical activity: exercise and sport. We incorporated walking as a form of exercise in the study, but we omitted investigations about the impact of music on gardening, housework, and physical labor; firstly due to the limited availability of such studies, and secondly because they do not align with the key areas of focus [8]. The study domain is significant from an empirical standpoint, as the normally reduced coaction and interaction, along with less intricate kinematics in the exercise domain, suggest that the effects of music may be more pronounced here than in the sports domain. The research domain is incorporated as a potential moderator in our meta-analysis.

Given that dancing is a prevalent kind of physical activity intrinsically associated with music, we contemplated the incorporation of dance-related research. Nonetheless, there are at least two persuasive justifications for the exclusion of the extensive corpus of dance-related research from the current analysis. Initially, comprehensive evaluations of the advantages of dance therapy have been published. Secondly, we concentrate on categories of physical activity where the experience may be improved—such as performance levels or psychological responses—by the incorporation of music, so amplifying any intrinsic benefits of the activity [6]. Consequently, we have omitted physical activities that use music as a fundamental element, like dance, ice skating, and rhythmic gymnastics. Such activities involve a physical interpretation of a musical composition, and since music is fundamental to them, it is significantly difficult to isolate the impact of music on the human organism's response.

Objectives

The following are the objectives of this study:

1. To find out the general exercise response to aerobics while listening to music
2. To understand the psychological effects of music on physical exercises
3. To find out the physiological impact of music on an individual while doing aerobics
4. To find out the psychological effects of anaerobic and sprint

Methods

The methodology used in this study was a comprehensive literature review. Where a comprehensive search was conducted on the psychological effects of music on physical exercise performance. Articles selected ranged within 5 years of publication. The reason that the years of publication were limited to 5 years was because not many studies have been done on the topic. Also, only abstracts and articles published in the English language were considered as a way of avoiding bias in the audience. The search included several phrases and words. The researcher also did an electronic search which was

completed with keywords like 'music', and 'sports' The database that was used in conducting the electronic search included; E-Journals; ERIC; Library, Information Science and Technology Abstracts; PsycARTICLES; Psychology and Behavioral Sciences Collection; PsycINFO; ProQuest; PubMed; Science Direct; Scopus; and SPORT Discus. The researcher also made use of Google Scholar was used to search for additional studies.

2. INCLUSION CRITERIA

To be eligible, the literature had to have been published within 5 years, needed to have used music as an intervention, have been conducted in a sports setting or exercise setting, including a no-music control group, been available in the English language and been published in a peer-reviewed journal before the cutoff date. Studies were also excluded if the effect of music intervention was not isolated from them, for example, those accompanying video footage, visual manipulation, and imagery.

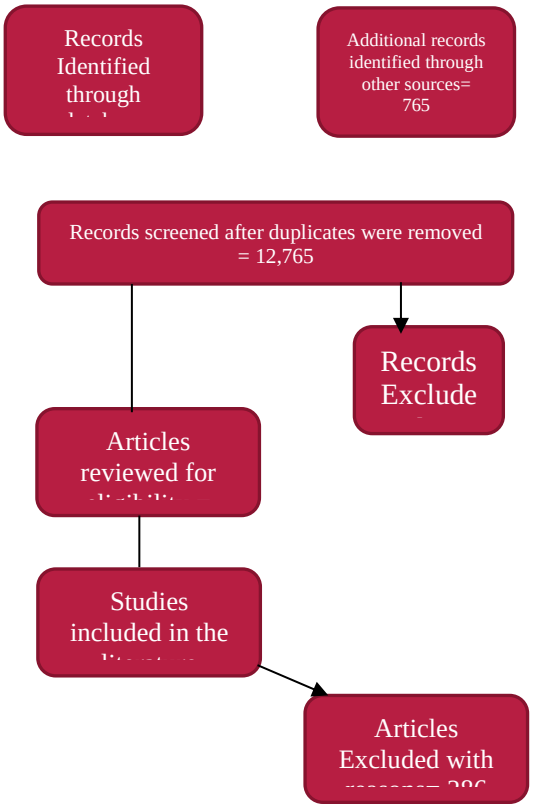

Fig 1. Above: Showing article research synthesis

3. RESULTS

General exercise response to aerobics while listening to music

Music is believed to affect exercise performance via three primary mechanisms: psychological, physiological, and psychophysiological. The subsequent two parts will succinctly examine the psychological and physiological alterations associated with exercising while listening to music [8]. Moreover, each of these divisions is interconnected by psychophysiological systems. These sections establish a basis for elucidating mechanistic results on the influence of music preference on exercise responses in subsequent parts.

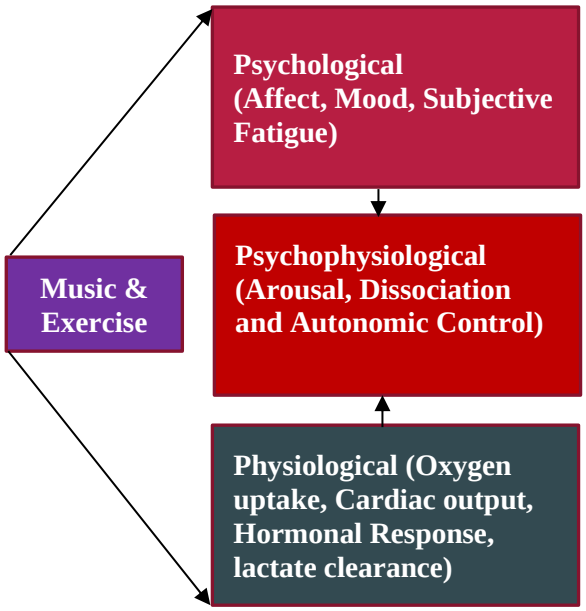

Fig 2. Above: Shows the impact of music and the body response during physical exercises

Psychological effects of music on physical exercises

Psychological alterations due to exercise have been extensively shown to affect sports and exercise performance. Psychological responses affecting exercise performance may pertain to well-being, and cognitive, emotional, and behavioral dimensions, which can influence both exercise adherence and capability. Reduced tension, melancholy, and rage, along with increased vitality, have been correlated with enhanced sports performance [5]. Regardless of physical activity, music is posited to affect several psychological dimensions. Previous studies have indicated enhancements in positive emotions, mood, and perceived weariness while engaging with music. The dependence of optimal exercise performance on many psychological states and the capacity of music to modify these states has led to extensive research examining the psychological effects of music on peak performance [8]. This section discusses major features of psychological responses to exercise that may be particularly relevant to music and exercise performance, although it does not cover all such responses in the research.

Music has been effectively characterized as a facilitator of arousal during physical activity. Inherent properties of music, such as elevated pace and volume, have been shown to facilitate increases in arousal, which correspondingly enhance performance. Alterations in arousal during music listening remain inadequately comprehended, however, imaging studies have demonstrated their manifestation in specific brain regions associated with emotion and emotional reactions. Friesen & Patrick, reported heightened activity in the left inferior frontal gyrus, which was proposed to enhance arousal and redirect attention from the exercise stimulus [5]. Consequently, variations in affective arousal during music listening seem to possess physiological foundations, which collectively may facilitate ergogenic advantages.

In contrast to vigor and excitement, subjective weariness, defined as the sensation of diminished energy, has been demonstrated to be positively influenced by music. Liu et al. indicated that rapid-tempo music therapies mitigate mental fatigue associated with sports and exercise. Enhancements in fatigue may also be associated with workout recuperation. Listening to soothing music after exercise has been demonstrated to enhance recovery and reduce felt weariness [9]. The feeling of exertion (RPE) is arguably the most consistent aspect influenced by music during exercise weariness. Nakamura et al. demonstrated that the Rating of Perceived Exertion (RPE) was markedly reduced while participants listened to music during endurance cycling. Music-mediated reduction of RPE has also been demonstrated in many exercise modalities, including high-intensity repeated sprints and resistance training.

A reduced RPE is likely attributable to dissociation, wherein the external stimulation of music distracts or diverts attention from discomfort and exertion [4]. The physiological foundation for reduced RPE has been elucidated, indicating that brain activity is modified due to the redistribution of attention towards the external stimulus of exercise. Nonetheless, it is important to note that numerous studies have indicated minimal to no alterations in the aforementioned psychological aspects during exercise or their lack of impact on performance [10]. The reasons for the discrepancies in findings remain unclear; however, variations may stem from differing exercise modalities, intensity levels, participant demographics, and types and selections of music [4]. An individual's preference for the music they are listening to significantly affects mood states and ratings of perceived exertion (RPE). Consequently, the evaluation of personal preference when engaging with music during physical

activity may be very significant. Silva et al. [11] state that music-related therapies have been widely used in training and exercise to improve physiological variables, prevent mental weariness [11], and possibly even boost performance [12]. There has been an increasing interest in using music to improve the context of sports and exercise in recent years [13]. The ergogenic effects of music in a range of exercise modalities, including weight training, cycling, running, and dart throwing, have been thoroughly investigated [14]. Through enhancing work capacity or influencing psychological factors including motivation, mood enhancement, and higher psychomotor arousal, music has an ergogenic effect that makes working out more pleasurable [14].

Running is a common physical exercise worldwide that requires minimal equipment and effort. Therefore, it is easily accessible for many people. Previous research has reported that music can facilitate running by diverging the attention on discomfort feelings during exercise [11]. The discomfort feelings can be defined as physical sensation that an individual experience during performing an exercise. It is commonly used by Borg's ratings of perceived exertion scale (RPE) to measure the hardness of exercise [14]. At the moment, results from pertinent research consistently imply that listening to music during exercise reduces the perceived exertion [15]. According to a study by Feiss et al. [16], participants who exercised while listening to music had lower RPE scores than those who did not. Furthermore, compared to the no-music condition, Karageorghis et al. [12] discovered that the RPE is higher with high speed music. Attentional processing explains this musical influence. External factors, such as music, can be processed alongside physiological cues that reduce the response to the information process if the training is conducted at a low or moderate intensity [12].

Music preference has been demonstrated to play a significant influence in physiological and psychological variables [15]. Listening to preferred music has been shown to increase cycling distance and RPE when compared to non-preferred music [17], explained that if non-preferred music is chosen, tempo can be a hindrance to pacing for runners since people tend to synchronize stride or movement to a specific tempo [1]. Another study that investigated the effect of song tempo on the treadmill found that an increase in the tempo, resulted in an increase in running speed. Furthermore, listening to music that is faster than 120 beats per minute (bpm) while running at a moderate pace significantly improves workout adherence [18]. While slow-tempo music has been shown to have relaxing benefits and be appropriate for low-intensity activities like warm-down sessions, evidence suggests that high-tempo music has good effects on performance [17]. According to research on song tempo, it is conceivable that people's running speeds could be influenced by music tempo. Music classified as "motivational."

In order to psychologically urge someone to perform a workout, the perfect song pace for endurance running could be somewhere between medium and high beats. Considering that another study included a 1.5-mile time trial with self-selected music and no song tempo recommendations. According to Karageorghis et al. [11], the selected songs in his study had an average tempo of 118 bpm, which just barely qualifies as fast-beat music (120 bpm). As a result, the suggested song speed range for the current study is 121–131 bpm. It is obvious that adding a song with a suitable speed could have an ergogenic impact. Therefore, the lack of a song tempo recommendation may be the cause of the discrepancies in earlier findings.

Physiological impact of music on an individual while doing aerobics

The physiological mechanisms responsible for performance increase during music listening are many, although isolating specific contributions is challenging. This may partly result from concurrent systemic physiological changes during exercise, alongside the pleiotropic character of the response to music [19]. Although further information exists outside these areas, they seem to be the most pertinent to the exercise response and will constitute the emphasis of the remainder of this section. Despite the presence of contradictory evidence, numerous studies, many of which cannot be addressed in this review, have documented music-induced brain alterations during exercise, both centrally and peripherally. Numerous studies have demonstrated that music enhances activity in brain regions critical for physiological arousal, emotion, and perception. Prior research has indicated heightened activity in the left inferior frontal gyrus and insular brain when listening to music during isometric exercise, as observed using functional magnetic resonance imaging (fMRI) [1]. The activation of these brain regions may indicate potential enhancements in cognitive processing speed and physical coordination while listening to music during exercise. The coordination of movement with music may enhance exercise efficiency [20]. Moreover, additional research indicates that theta wave activity, associated with relaxation and sleep, diminishes in the cortical surface during music listening, possibly signifying alterations in physiological arousal that may enhance exercise performance [1]. Neurological alterations during music listening may also be evident in peripheral divisions, including activation of the autonomic and somatic nerve systems.

Listening to music while cycling has been associated with the maintenance of heart rate variability (HRV) post-exercise, suggesting the retention of parasympathetic activation after physical exertion. Nonetheless, this may be variably influenced by the genre of music the individual is engaging with [1]. Relaxing music has been demonstrated to reduce norepinephrine levels, whilst fast-tempo music has been found to elevate epinephrine levels during exercise. Other researchers have seen reduced plasma catecholamines while listening to classical music during treadmill jogging. Although unverified, it has been proposed that the reductions in catecholamines indicate less sympathetic output, potentially affecting blood and oxygen supply to peripheral skeletal muscle. While preliminary studies indicate a superior efficacy of favorite music, the methods

via which it confers larger benefits remain under investigation. Variations in exercise response based on differing music preferences seem to be pleiotropic, potentially influencing psychological, physiological, and/or psychophysiological factors [21]. This section of the review will elucidate the current research regarding various kinds of exercise and the timing of interventions involving preferred and non-preferred music.

In one study, a researcher noted that participants in a 6-day cycling competition rode 8.5% quicker when a military band was playing, researchers have looked into the advantages of music during physical activity and sports. Since then, it has been demonstrated that listening to music enhances physical performance in a variety of tasks [12]. Research suggests that listening to music while performing tasks related to sports and exercise has a number of interconnected advantages.

Pretask music, for instance, has been effectively employed as a sedative [14]. Music has the power to produce positive emotional states and divert athletes or exercisers from the bad feelings that come with exertion and exhaustion. These advantages might be a factor in the ergogenic effects that empirical research has found. These impacts include enhanced work rate, increased endurance, and higher strength and power production. Both when participants synced their movements with music and when they did not, ergogenic effects have been documented [13]. The form of music delivery is a moderator variable in the current literature review study since it is of significant empirical and theoretical interest. Although there is a growing body of research on the topic, little is known about how music can help people recuperate from physical exertion. Numerous studies have shown how effective calming music is at promoting recovery after moderate-to-intense and high-intensity physical activity [14]. Empirical evidence supports music's ability to alter a variety of physiological processes, including heart rate, breathing, skin conductance, motor patterns, neuroendocrine response, and immunological function. During physical exertion, music has also been shown to have comparable physiological effects [13].

Karageorghis and associates have released a number of conceptual models that illustrate the several ways that music influences physical activity. The circumstances of therapeutic outcomes, athletic performance, and auditory-motor processing are likewise represented by a person's metatheory. According to a different theoretical paradigm, music affects affective and emotional reactions through eight psychological systems. One of these, the brain stem reflex, is the process via which the basic auditory characteristics of music elicit reactions by indicating a potentially significant or urgent event [16]. For instance, regardless of how the music is later evaluated, quick, loud music would inherently excite the listener by triggering the central nervous system. Blood pressure, body temperature, skin conductance, muscle tension, and heart rate all rise as a result of this stimulation [22]. The opposite is true with calm, gentle music, which lowers sympathetic arousal. Such calming music frequently imitates the calming sounds of nature, such as cooing, purring, and mother vocalizations [14].

The ability of the musical stimulus to arouse becomes crucial when high levels of psychomotor arousal are desired, as in high-intensity training sessions [14]. The biomusicological process of rhythmic entrainment is associated with this. The rhythmic elements of music attract the pace of movement and physiological pulses, including heart and breathing rates, to synchronize. People consistently state that they prefer a rather high tempo when engaging in vigorous exercise [16]. Similarly, music can prime an athlete before a training session or as part of their precompetition routine because brain waves tend to synchronize with musical tempo. According to a different study, music may influence us by triggering emotional associations, a process that may be dependent on subcortical systems. Appraisal theory states that an individual's subjective assessment of the event is the source of their affective reactions to music during physical activity [15]. Juslin's theory of evaluative conditioning, which describes the repetitive pairing of a certain musical composition with other stimuli that have a positive or negative valence, is somewhat connected to this idea. Repetition of a certain song, for instance, can make it inexorably associated to an especially enjoyable physical exercise session.

In this process, a previously neutrally valence-conditioned stimulus (such as music) learns to elicit the same emotional response as a positively valence-unconditioned stimulus (such as an enjoyable physical activity experience). This is an example of classical conditioning.

To find out the psychological effects of anaerobic and sprint

The impact of music preference on anaerobic activity remains the least comprehended. Zhang & Tian [3] examined whether listening to favorite music could elicit alterations in anaerobic threshold intensity. In both genders, listening to favorite music did not elevate anaerobic threshold intensity; however, females demonstrated superior performance at elevated intensities. Nonetheless, the exercise regimen employed was an incremental running test, which is not exclusively classified as anaerobic. Thus far, only a single study has elucidated the impact of music preference on actual anaerobic sprint exercise performance. My group recently investigated the impact of listening to preferred versus non-preferred music on performance in repeated Wingate anaerobic tests (WAnT), a maximal sprint assessment conducted on a cycle ergometer [4]. Fourteen physically active males performed three sets of 15-second modified Wingate Anaerobic Tests, interspersed with two minutes of active recovery. Participants listened to either liked or non-preferred music while exercising. Subjective evaluations of RPE and motivation were conducted following each WAnT. No performance measures (i.e., power output, anaerobic capacity) exhibited differences among the music situations.

4. DISCUSSION

The study from the literature review shows that heightened exercise intensity can prompt a transition in attention from an exterior focus on the environment to an interior focus on physical sensations, including muscle contraction and respiration. Prolonged maintenance of a specific workout load results in an escalation of perceived exertion levels over time [5]. This phenomenon aligns with our observation that RPE values post-intervention were highest for EI compared to all other therapies. The lower RPE level for the EM intervention compared to the EI intervention aligns with the widespread application of music stimuli to diminish perceived exertion ratings during repetitive endurance tasks [22]. An enjoyable audiovisual stimulation may alleviate fatigue-related symptoms and diminish the physiological stress caused by exercise sessions.

The current study found that the average pace of the music was 128.01 bpm, aligning with the optimal heart rate range for aerobic exercise interventions (about 120–140 bpm). Nonetheless, we discovered no direct evidence of a definitive association between music pace and heart rate during physical activity [7]. A meta-analysis endorsed the utilization of music listening throughout various physical activities to foster a more favorable affective valence, augment physical performance (i.e., ergogenic effects), diminish perceived exertion, and boost physiological efficiency. Interventions that incorporate aerobic activity alongside rhythmic music may maintain an elevated heart rate and result in a reduced Rate of Perceived Exertion (RPE) when participants' cadence aligns with musical tempos.

The dissociation impact of preferred music genre seems to reduce RPE during exercise. Preferred music decreased RPE in the music group as compared to the no music group, which is consistent with other research. After conducting strength-endurance tests, Silva et al. [13] found that participants who listened to music had a lower RPE than those who did not. Furthermore, most of the research analyzed in this study shows that listening to music that is desired during an exercise lowers RPE when compared to music that is not [7]. Favorite music is a good way to distract oneself, and its inspirational qualities might influence one's physical performance. As a result, exercisers can use their favorite and motivating music to increase the length of their workouts and enhance their physical performance.

The literature review findings offer compelling proof that music of all tempos improves affective valence and that music-induced decreases in perceived exertion happen at both low-to-moderate and high levels of exercise intensity. The extent to which music can improve exercise-related affect and lower perceived exertion over the ventilatory threshold should be further assessed by researchers [6]. Due to significant variance in how intensity was set, the data in the current meta-analysis did not permit such a precise assessment of the association between labor intensity and the advantages of music. A technical aside is that instead of using more conventional heart rate-based methods, like the well-known Karvonen formula, which results in inconsistent work intensities among participants, researchers are recommended to establish work intensity in relation to ventilatory threshold [5].

The psychological impacts of music after training, competition, and exercise is a field of study with room to grow significantly. This use is especially relevant to those who participate in high-intensity activities, which are common in many sports, as they may suffer from symptoms including mood swings and delayed-onset muscular soreness brought on by microtrauma to muscle fibers. Additionally, the literature analysis demonstrates that post-exercise recovery techniques have mostly overlooked the importance of the central nervous system in the healing process, instead concentrating on the regeneration of muscle physiology through techniques like massage, stretching, and ice baths.

There is room to investigate the effectiveness of calming music in accelerating and improving the quality of recovery, given that music has the ability to both stimulate and sedate the central nervous system. Although methodological rigor has been questioned in certain research, there is a growing body of evidence that supports the use of recuperative or post-task music [23]. As a result, a program of systematic study is required to advance this field and ultimately influence evidence-based practice. The incorporation of both active and static recovery in study designs is one specific enhancement that has to be made to research on the recuperative effects of music. Up until now, studies have tended to look at either one of these recovery periods. Additionally, the quality of the evidence base will be improved by employing measurements sensitive to the rate of post exercise recovery and standardizing work intensity among participants. There are currently no comparable techniques for evaluating the sedative effects of music, despite the fact that there are standardized procedures for evaluating the motivational effects of music in the context of exercise and sport [25]. Research on the healing properties of music would advance as a result of this development.

From a methodological perspective, it is crucial to determine whether music-related interventions make relatively high-intensity physical activity (near the ventilatory threshold) that is linked to notable cardiorespiratory benefits more appealing, which in turn encourages exercisers to stick with their regimen longer or develop a habit of exercising [5]. Given the dramatic increase in sedentary behavior and the associated disorders observed in affluent nations over the past 20 years, such research would have broad public health consequences [5]. Future research should theoretically focus further on the mechanics underlying music impacts, such as the concept of entrainment. One strategy would be to use noninvasive techniques that are immune to movement artifacts, like functional near-infrared spectroscopy, to investigate context-specific brain responses to music during a variety of physical activities [7]. A different strategy would involve employing online respiratory analysis

[5] to further evaluate the impact of auditory-motor synchronization on metabolic efficiency, and combining this with biomechanical efficiency indicators such movement sensors to evaluate the regularity of the kinetic chain [7]. The mechanistic models that would result from this effort would complement the heuristic and metatheoretic models that have been presented in this field over the past ten years [8].

5. CONCLUSION

In summary, the cumulative evidence in the research literature indicates that music listening during exercise and sport can yield substantial positive effects for exercisers and athletes, particularly regarding enhanced emotional responses and improved physical performance, as well as reduced perceived exertion and more efficient oxygen utilization. Such repercussions are not necessarily inevitable. Almost all advantages linked to music listening during exercise and sports are likely to be minimal and may be confined to enhanced mood and reduced perception of exertion. However, there exists the potential for authentic enhancements in physiological efficiency and physical performance, which could be significantly beneficial for athletes engaged in activities where the distinctions between success and failure are exceedingly narrow. A primary objective for practitioners is to implement music-related interventions to improve effect and enjoyment during exercise, hence increasing adherence among formerly sedentary individuals. The primary problem for academics and practitioners is no longer to debate the possible benefits of music for exercisers and athletes since its efficacy is evident, but rather to elucidate ideal methods for its utilization.

Overall, it is reasonable to draw the conclusion that music has the potential to significantly benefit athletes and exercisers, especially in the areas of improved physical performance and enhanced affective responses, but also in terms of decreased perceived exertion and more effective oxygen utilization, given the summative evidence in the research literature supporting music listening for exercise and sport across a range of outcome variables. However, these impacts are by no means unavoidable.

It's crucial to avoid the kind of irrational conclusions that emerged when studies revealed that listening to a Mozart sonata improved spatial-temporal reasoning as assessed by the Stanford-Binet IQ test. These results led to, among other things, Georgia allocating a substantial yearly budget in 1998 to support the distribution of a CD with classical music to each and every child in the state. A further meta-analysis of the so-called Mozart effect showed that any cognitive improvement was slight, transient, and did not indicate a long-term shift in IQ or general reasoning skills.

It is crucial to remember that the advantages of music listening prior to or during physical exercise are not assured, even though the current findings provide a strong body of data. For instance, despite the fact that athletes frequently employ pretask music and many of them swear to its advantages, our findings indicated that performance gains are probably minimal but potentially significant. Although there is a chance for real improvements in physiological efficiency and physical performance, the majority of the benefits of music listening during exercise and sports are likely to be minor and limited to feeling better and experiencing less exertion. We acknowledge that any such benefits could be extremely valuable for athletes participating in sports where the difference between success and failure can be very small. Applying music-related interventions to improve affect and enjoyment during exercise is a clear goal for practitioners in an effort to increase adherence among formerly sedentary individuals.

Clarifying the best ways to employ music is the main problem for researchers and practitioners, rather than speculating about whether it has the potential to aid athletes and exercisers, as it obviously does.

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