

INFLUENCE AND EFFECT OF MUSIC ON EXERCISE

Influence and Effect of Music on Exercise

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A major rising public health concern, especially in children, that is growing nearer to affecting nearly half the American population, is obesity<sup>4</sup>. Obesity is known to lead to further serious health problems such as cardiovascular disease, diabetes mellitus, cancer, high blood pressure, high cholesterol, asthma, and even joint problems<sup>4</sup>. Of the many contributing factors associated with obesity is physical inactivity as it has been seen to increase fat stores, decrease caloric expenditure, and decrease tolerance to glucose<sup>4</sup>. Interventions to reduce the risk and prevalence of obesity involve decreasing sedentary behaviors by increasing physical activity; however, implementing this can be more difficult than perceived because individuals need to be motivated to exercise as well as enjoy it in order to maintain adherence<sup>4</sup>. There are a variety of claims, including factors with goals, to achieve this enjoyable environment, however research has shown very promising effects with music as an influence for motivation and enjoyment when exercising<sup>1-9</sup>. Motivationally, the presence of music has been shown to be of encouragement to continue exercising in the future by increasing affective state and mood as well as by distracting the individual from overthinking the idea of exercise as a negative thing<sup>1,2,3,7</sup>. The presence of music during exercise has also been shown to decrease the feeling of how much work the individual feels they are doing<sup>2,6,9</sup>. The type of music, genre, pace, and overall preference, are also factors that are considered when evaluating the effectiveness and influence that music has on exercise<sup>3,5,7,8</sup>. The presence of music prior to and during exercise has proven to be of importance to consider when attempting to achieve the goal of sustained exercise participation due to the motivational influence, effect of less perceived work, and the effects of overall music preference<sup>1-9</sup>. The purpose of this paper is to compile research in order to analyze the effects and

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influences that the presence of music has on exercise based on the motivational influences, effect of less perceived work, and the effects of overall music preference <sup>1-9</sup>.

The effect that music has during exercise is widely researched and studied, however, it is also important to understand the influence that music can have prior to exercising, as motivation to go and continue exercise participation <sup>3</sup>. As a pre-exercise motivator, music serves to bridge the gap between intention to exercise and the action of exercising through cognitive responses <sup>3</sup>. Music has been shown to stimulate physiological arousal which has been linked to increased heart rate and respiration rate as well as increased hormone and neurotransmitter levels <sup>3</sup>. The increased release of neurotransmitters during exercise, often endorphins, dopamine, norepinephrine and serotonin, is associated with boosts in mood and state of mind which explains the “runner’s high” or physiological arousal that comes from exercising <sup>3</sup>. Music is often listened to in order to change emotions, thus impacting an individual’s physiological state <sup>3</sup>. People often actively use music in a variety of interpersonal and social contexts to produce these varying physiological states; thus, further suggesting that music is a precursor to achieving a desired state <sup>3</sup>. Therefore, the presence of music before exercise can influence a more positive physiological state of mind directed towards the action of exercising and can be a motivational factor to bridge the gap between intention and action to then full adherence <sup>3</sup>. While exercising, music continues to affect the body physiologically by aligning intrinsic and extrinsic frequencies of the body, such as aligning heart rate and brain cortical activity with the oscillation patterns of the music <sup>7</sup>. The alignment of these physiological brain functions during exercise increase emotional regulation and show increases in work output and mood and can even stay aligned fifteen minutes after exercise, leaving individuals in positive mood after completion, thus

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contributing to exercise adherence <sup>7</sup>. The feeling of being satisfied through intrinsic and extrinsic frequency alignments during exercise in itself contributes to exercise adherence but to then also have the frequencies and thus positive feeling after exercise makes individuals more likely to return to exercise because it left them feeling good <sup>7</sup>. Satisfaction in the form of a positive mood after exercise contributes to further exercise participation in the same way that satisfaction in the form of completing workout goals and seeing positive results from it also increases exercise adherence <sup>3,7</sup>. When placed in environments in the presence of music and without music, individuals were more successful in completing their workout and completing their exercise goals while in a music filled environment when compared to a music-free environment <sup>3</sup>. While exercising with music, individuals expressed more enjoyment and less fatigue, often associated with exercise, making it easier and more enjoyable to continue the workout until exercise goals were met <sup>3,5</sup>. Since music increases overall enjoyment, physiological state and the likelihood of meeting exercise goals, an increase in exercise adherence is also noted due to positive physical appearance results and also emotional positive results from the exercise intervention <sup>3</sup>. Music has been proven to make exercise enjoyable for some individuals, but unfortunately it is not enjoyable for everyone. So, in addition to positively altering physiological state or mind, music can be provided as a distraction factor during exercise <sup>1</sup>. Similar to music impacting state of mind, music gives the mind something else to focus on instead of commonly overthinking the task of exercising <sup>1</sup>. The most beneficial outcomes seen, with the distraction that music can serve as, are within movement therapy and intervention <sup>1</sup>. Within movement therapy, music improves balance, functioning gait, walking velocity and overall quality of life because instead of focusing on the view that exercise is a chore/task, music allows for the mind to focus on something currently positive <sup>1</sup>. The relationship between music and exercise reveals that listening to music

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while exercising reduces the feelings of fatigue often highly associated and generated by exercise and thus heightens the interest to pursue the exercise/workout repeatedly<sup>5</sup>. Music increases the likelihood of exercise adherence by serving as a motivational factor prior to and during exercise by positively altering physiological state of mind and arousal, aligning intrinsic brain activity and extrinsic music frequency, and distracting the individual from the exercise itself<sup>1,3,7</sup>.

Once exercising, a barrier that poses as an issue for individuals is the amount of work they feel like they are doing; if they feel overworked, then they are less likely to adhere to continued exercise participation than if they feel like they are doing less work with the same outcomes<sup>2,6,9</sup>. When listening to music during exercise, individuals often perform a significantly increased amount of work, but subjectively report to feeling as though less work had been done<sup>2,6,9</sup>. The presence of music during a workout is proven to lower the individuals rate of perceived exertion, the intensity the individual feels they are performing<sup>2,6,9</sup>. The Rated Perceived Exertion (RPE) scale subjectively measures exercise intensity based on how easy or difficult the individual feels their exercise/workout is<sup>6</sup>. This subjective test is on a scale of one to ten, one being little to no effort and ten being max effort<sup>6</sup>. When participants report the same perceived exertion rating during cycling given two music conditions, presence of music and lack of, participants increased objective workload by cycling a further distance in the presence of music<sup>2</sup>. Likewise, when comparing the same workout or exercise in the two conditions, with and without music, the average perceived exertion was lower on the scale in the presence of music, indicating that music makes individuals perceive that less effort is required to complete the same workout<sup>2</sup>. While participants overall report lower exertion ratings during exercise in the presence of music, research has also shown that there is a greater significance in lowering RPE

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ratings at low submaximal exercises in comparison to moderate or high intensities in the presence of music <sup>9</sup>. Similarly, untrained individuals are more likely to experience a greater influence on RPE rating and improved performance while in the presence in comparison to a trained individual <sup>6</sup>. Individuals who are new to exercising, thus often needing to begin at lower intensities, experience more significant changes in perceived effort and intensity to which they are performing between the two music conditions <sup>6</sup>. Trained individuals have, overtime, already trained their bodies to take a longer time to become exhausted, to reach their max performance or a ten on the RPE scale, thus there is not as much significance that music has in decreasing their exhaustion rate <sup>6</sup>. However, for untrained individuals, the presence of music significantly lowered their RPE during the beginning of submaximal exercise, at a low intensity, thus overall significantly decreasing the amount of time it took to then become fully exhausted, reaching a ten on the RPE scale <sup>6</sup>. This significantly lower RPE rating at lower intensities and specifically with untrained individuals should be taken into consideration for exercise intervention and in attempts to improve exercise adherence. Exercise adherence applies to individuals who are untrained and thus need to begin at lower intensities and if the presence of music in exercising environments lowers the perceived exertion and intensity level they feel they are at then they will be more likely to continue <sup>2,6,9</sup>. In the case that the presence of music allows an individual to do more objective work due to the feeling of less effort exerted, their affective state/mood stays the same and does not decrease with the additional work load <sup>2</sup>. Feeling to have done less work in the presence of music actually increases objective workload; while more work would normally suggest a decrease in affective state and mood, music allows their mood to stay the same while increasing the workload and performance results, showing an overall change increase in the cognitive enjoyment during exercise <sup>2</sup>. Altogether, the presence of music has significant effects

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on lowering the rating of perceived exertion in general, increased significance in untrained individuals and at lower intensities, and also has a greater change in affective state/mood when increasing the amount of objective workload, which should all be considered with the goal of exercise adherence <sup>2,6,9</sup>.

Music in general has proven to have significant influences on multiple aspects of exercise, however the type of music, whether it be determined by speed, genre or even preference, can change the influence that music has on any given individual during exercise <sup>3,5,7,8</sup>. A majority of experimental studies evaluating the influence and effect that music has on exercise, has only evaluated the single experimental condition of music presence however, there are other conditions and variable that need to be considered in order to further consider the influence <sup>5</sup>. A variable associated with music, that can be altered and considered, is speed/tempo. It is already known that music can change the emotional response of an individual by altering physiological functions within the body and thus, increasing or decreasing the tempo of the music at hand can also influence the physiological response and thus the performance during exercise <sup>5,7,8</sup>. When simply comparing the exercise responses between fast-paced and slow-paced music there were consistent and yet varying outcomes <sup>5,8</sup>. In the presence of slow-paced music during exercise, norepinephrine concentration levels measured a significant decrease in comparison to fast-paced music and lack of music conditions <sup>8</sup>. Decrease in norepinephrine levels is related to affective decreases in agitation and uncomfortableness, which during exercise is beneficial as it overall improves the comfortability and positive reaction to exercise, opposite of typical reactions <sup>8</sup>. In addition to reducing agitation and uncomfortableness, specifically listening to slow-paced music during exercise, individuals expressed feeling calmer making it

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more psychologically helpful in stress-reducing exercise <sup>5</sup>. On the other hand, in the presence of fast-paced music, individuals had a measured increase in epinephrine concentration levels in comparison to slow-paced and lack of music conditions <sup>8</sup>. Increased epinephrine concentration levels are linked with adrenaline and increase heart rate and work output <sup>8</sup>. Increased heart rate aligns with the frequency of the fast-paced music thus increasing adrenaline, fight-or-flight response, which is a main contributor to increased work output during exercise <sup>8</sup>. The speed of the music is an important consideration based on what the goal of the specific exercise is; if the goal is to enjoy exercise more, then slow-paced music will increase comfortability and calmness, however, if the goal is to increase workload and output, then fast-paced music will increase adrenaline and heart rate to make it so <sup>5,8</sup>. Even though these responses to different speeds of music significantly impact exercise performance and experience, the preference to these varying speeds as well as genre and general preference can also alter the experience and effect that music offers during exercise <sup>3,5</sup>. The general presence of music makes a considerable impact on exercise, however it is human nature to want control, and if control over what type of music is being listened to, can increase the significance that music presents during exercise, then it should be considered. Similar to observing the differences in speed/tempo of the music, when comparing stimulative versus sedative genre music and also the preference of them, there were significant results in the effects on exercise <sup>5</sup>. Stimulative music is characterized by high activity and energy, including fast-paced music, and is designed to arouse listeners <sup>5</sup>. In contrast, sedative music serves to calm or sooth the mind and individuals, including slow-paced music <sup>5</sup>. When randomly assigned either sedative or stimulative music to listen to during exercise, individuals reported the music to not be of any psychological help if it was not what they had noted to be preferable, despite the associated influences that each type of music presents <sup>5</sup>. This further



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explains that preference of music is a considerable factor, as having music present, but not connected to the individual, is not as effective as the presence of music that is specifically chosen and favored by the individual. On the contrary, when an individual was able to select the type of music that they preferred, either stimulative or sedative, it was of more psychological help than in an exercise environment with unchosen music<sup>5</sup>. Choosing a preferred type of music, in addition to increased psychological help, also was linked to increased exercise goal completion<sup>5</sup>. This concept of preferred music choice being of more benefit to individuals exercising stands true in all aspects of an exercise, including the warm-up, cool-down, and main exercise activity<sup>5</sup>. Research by Lee, K, et.al. found that the preference of music in a population during an exercise routine, varied based on the phase on the exercise being completed<sup>5</sup>. During the warm-up phase, the preference of music, between stimulative and sedative, was split nearly half and half however in the workout and cool-down phases there was more total group preference separation<sup>5</sup>. During the workout itself, more participants preferred stimulative music, which is associated with the increased adrenaline and high activity/energy<sup>5</sup>. Likewise, during the cool-down phase of the exercise more participants preferred sedative music as it calms the body down after a high work output during the workout<sup>5</sup>. Listening to music suited to one's preference for each phase of exercise, can stimulate exercise participants so that mental and physical arousal levels are met and maintained for increased adherence<sup>5</sup>. The consideration that the type of music preferred changes throughout the workout, suggests that allowing individuals to choose specific music preferences throughout the exercise routine, will result in more positive outcomes such as increased work output, increased mood, and overall increased exercise performance<sup>5</sup>. The pre-selection of preferred music has also shown to increase enjoyment of the entire exercise, through which then increases the likelihood of seeing positive results which individuals associate with

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being more confident with participation and adherence<sup>3</sup>. Music has shown to influence mood and emotion, so selecting a music genre or song that connects and relates to the individual on an emotional and personal level is often associated with encouragement to continue exercise participation<sup>3</sup>. As mentioned, the oscillation patterns of any given music, align with the intrinsic frequencies of the body, including heart rate and brain cortical activity, of which vary for every individual<sup>7</sup>. Considering that these extrinsic and intrinsic frequency alignments impact the performance and associative feeling of exercising, it is ideal to find the perfect alignment of the frequencies, thus perfect kind of music, to achieve the most beneficial outcomes in response to exercise<sup>7</sup>. Finding and then using an adequate music choice for exercise will perfectly align the intrinsic frequencies to the music, amplifying the increased work output and mood<sup>7</sup>. Peak intrinsic frequencies during exercise are shown to be roughly 3 Hz, while preferred music choice among a sample of exercise participants, averaged around 2.7-2.8 Hz<sup>7</sup>. This close proximity of frequency alignment between the extrinsic music preference and the intrinsic heart rate/brain cortical activity was highly associated with the positive effects of increased work output and mood<sup>7</sup>. While the presence of music as a whole is proven to be influential on exercise performance, the preference of the music present during exercise is another substantial factor to consider for enhanced experiences and results coming from the action of exercise.

There are many considerable factors that impact the response and effectiveness of exercise, however, the presence of music in various conditions of exercise, consistently provides significant and positive results. The presence of music has been proven to impact the full exercise session; motivates individuals prior to exercise, increases mood, enjoyment and work output during exercise, and then also leaving satisfaction in the form of positive moods and

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positive results after exercise completion, due to the presence of music <sup>1-9</sup>. The considerable influence that music has on exercise should not go unnoticed and should be appraised when aiming to enhance exercise adherence in order to decrease the overall prevalence of serious health concerns, such as obesity, that are strongly linked to the lack of physical activity. In conclusion, physical activity is essential to public health, and the benefits that take shape from it are principal to maintaining good health. However, these benefits are unachievable unless exercise is maintained and adherence is continued, thus significant and yet modifiable characteristics, such as music, provides motivation, increases emotion and mood towards exercising, and thus increases adherence <sup>1-9</sup>. Music serves as a pre-exercise motivator by bridging the gap between exercise intention and action by physiologically stimulating arousal, emotion and desired moods <sup>1,3,5,7</sup>. During exercise, music presence lowers the work capacity and intensity individuals feel they are performing and allows for longer bouts of exercise associated with increased objective work output and adherence due to positive results <sup>2,6,9</sup>. Beyond just the presence of music, the pace, genre and overall chosen preference of music present during all aspects of an exercise session, significantly increase the positive physiological, emotional and physical responses to exercise linked with increased exercise enjoyment and adherence <sup>3,5,7,8</sup>. Each of these characteristics associated with music and exercise are positive and significant in expressing the influence and effect that music has on exercise.

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