



تأثير الموسيقى على قوة قبضة اليد ودقة الأداء في الواجبات التي تتطلب أدراك عالي،  
وأدراك واطئ

## The impact of music on handgrip strength and performance accuracy in high and low cognition tasks

**Assist. prof. Dr. Bassem Khalaf**

Wasit University/ College of Basic education

Department/ Early Childhood

[Bassem.khalaf@outlook.com](mailto:Bassem.khalaf@outlook.com)

ORCID:0000-0001-5537-1069

*الملخص*

في هذه الدراسة، تم التحقيق في تأثير الاستماع إلى الموسيقى أثناء الأداء الذي يتطلب قوة بدنية من خلال اختبار قوة القبضة، كما تم اختبار الأداء الذي يتطلب طاقة إدراكية عالية من خلال دقة المكان، أي التركيز على الهدف أثناء الاستماع إلى الموسيقى. شارك في هذه الدراسة ستة عشر طالبًا، حيث أدوا اختبارين: الأول كان اختبار قوة القبضة، والثاني كان اختبار دقة المكان. جميع المشاركين كانوا رياضيين. أظهرت النتائج تأثير الموسيقى على قوة القبضة وكذلك على اختبار الدقة. ومع ذلك، كان تأثير الموسيقى على الدقة، التي تتطلب مستوى عالٍ من الطاقة الإدراكية أو الذهنية، أكثر أهمية من تأثيرها على قوة القبضة، التي تتطلب قدرة إدراكية أقل. يُعتبر هذا مؤشرًا مهمًا على دور الموسيقى في المتطلبات الإدراكية العالية. الاستنتاج، يعزز الإيقاع الموسيقي الأداء، سواء كان يتطلب قوة بدنية عالية أو طاقة عقلية واطئة. ومع ذلك، كان تأثير الموسيقى على الأداء الذي يتطلب طاقة عقلية عالية أكبر من تأثيرها على الأداء الذي يتطلب قوة بدنية كبيرة

## **ABSTRACT**

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In this study the effect of listening to music during performance requiring physical strength was investigated through the handgrip strength test, and performance requiring high cognitive energy was tested through spatial accuracy, i.e., focusing on the target while listening to music. Sixteen students participated in this study, taking part in two tests: the first was a handgrip strength test, and the second was a spatial accuracy test. All participants were athletes. The results showed the effect of music on grip strength as well as on the accuracy test. However, the effect of music on accuracy, which required a high level of cognitive energy, was more significant than on grip strength, which required a lower level of cognitive ability. This is an important indicator of the role of music on high cognitive demands. In sum the musical rhythm enhances performance, whether it requires high physical strength or high mental energy. However, the effect of music on performance that requires high mental energy was greater than on performance that requires great physical strength.

**Keywords:** accuracy, performance, music rhythm, high cognition, low cognition

## **Introduction**

Several studies have been shown to have a significant effect on perception and performance, for example physiological responses that influence during both passive listening and active performance. (Andrews & Wiggins., 2014; Hageman, 2018; McCrary & Gould., 2023; Stork & Marlin., 2017). Music can evoke emotional reactions and alleviate pain during medical treatment or

procedures. Also, rhythm can affect heart rate, breathing, fatigue, and muscle tension (El Boghdady & Ewalds 2020; Felszeghy et al., 2023; Terry et al., 2019) Music listening can improve cognitive task such as attention, memory, and problem-solving. (Crust & Clough 2006; Highborn & Palmer 2003; Maes et al., 2014) Some of studies showed music significantly enhances performance during high-intensity interval training. Participants amped up their power output and maintained higher heart rates when the beats were bumping. But it is not just about the physical perks. Music also improves state, it can elevate your mood, boost motivation, and even trigger the release of feel-good chemicals like dopamine. The previous studies have proven the effective role of music in stimulating the brain and improving performance.

In this study, we aim to verify whether music has the same effect on hand grip strength and performance accuracy. Since strength requires significant muscular power, music might help in enhancing it, while accuracy requires high concentration, i.e., mental strength. The difference is clear between the psychological requirements of physical strength and mental strength, which necessitates mental focus, see (Kuan 2017; Akhshabi & Rahimi 2012; Shohao 2023; Terry et al., 2012).

The study presents an intriguing exploration of the influence of music on both physical and mental performance metrics. The hypothesis suggests that music may have differing impacts on hand grip strength, which is largely a physical attribute, and performance accuracy, which relies heavily on mental concentration. The distinction between the psychological demands of physical strength and mental strength is indeed noteworthy and could provide valuable insights into how music can be strategically used to enhance various aspects of human performance. (Terry et al., 2012; Van der Zwaag et al., 2020) On other words hand grip strength requires low cognition, while accuracy requires high cognition. So, in this study we want to investigate about the impact music on

hand grip strength and accuracy of performance. The accuracy in the sport flid refers to achieving high- quality performance. There are several types of accuracy in sport, including motor accuracy, spatial accuracy, temporal an accuracy, coordinative accuracy, and tactical accuracy. (McCrary & Gould, 2023; stork & Marlin., 2017)

In this study metrologically we used spatial accuracy. The research question is whether music affects the grip strength that requires muscular effort as well as the same effect on mental requirements through concentration accuracy. Studies have generally proven the effect, but not in these details to find the percentage of influence between muscular and mental requirements, which is what this study seeks to investigate.

## **Method**

### **Participant**

16 students (21 years men: mean age, SD=2.1) participated in this experiment. They satisfied all requirements for volunteer gave informed consent approved by Education College, Ethics Committee at Mustansisriyah University. All participants considered themselves to be in good health, had no history of disease, and were not undergoing any medical treatment that might influence motor or vision-motor functions. The final sample size of 16 provides 80% power to detect effects with  $d > 0.72$ .

### **Procedures and design**

In this study, there are two tests: each participant listens to a sound rhythm “ Alex Rasov Just to be in love Alondra de la Parra& Joana Mallwitz”, by headphone for 5 minutes. the first involves testing accuracy by giving each participant 10 attempts with a sound rhythm at a free throw from 9 m towards a circular ring placed at the top corner of the target on the right and left sides,

with 5 attempts for each side. And 10 attempt without music or sound rhythm. Total of attempt 20. A successful attempt earns the participant one point, while a failed attempt results a minus one, see figure (1). In the second test, each participant also listens to same sound rhythm of music for five minutes. A participant was given three attempts to measure handgrip strength using a dynamometer: three attempts while listening to music and three attempts without listening to music or sound rhythm. A total of attempt six, three listening a music after and during action and three attempt without a music as control condition, see figure 2.



Figure (1) the scoring in the upper right corner and left in a handball goal  
 Figure (2) Dynamometer for measure of grip strength

## Results

The results of the impact music rhythm on performance  $t(15) = 2.82, p < 0.01$ , indicating highly significant results, while correlation  $r = .82$ , while handgrip strength as comparing between handgrip with music listening and non-music listening  $t(14) = 7.75, p > 0.001, r = 0.95$  while . see to Tables 1 for further detail.

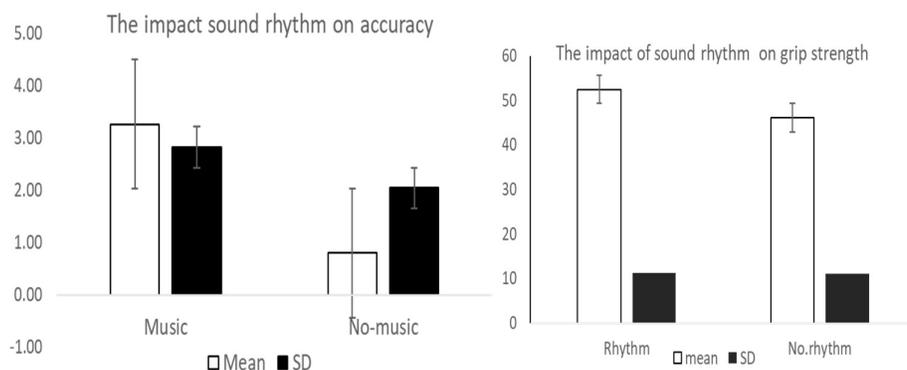


Table (1) descriptive statistics of attempt throwing ball & handgrip strength.

<i>music</i>	<i>no-music</i>		<i>MUSIC</i>	<i>NO MUSIC</i>	
Attempts of free throwing of handball form 9m			handgrip strength		
Mean	3.2667	0.8	Mean	52.44	46.094
Standard Error	0.73	0.545108115	Standard Error	2.79	2.784
Median	3.00	2	Median	51.3	46
Mode	2.00	2	Standard Deviation	11.171	11.137
Standard Deviation	2.81	2.111	Sample Variance	124.784	124.023
Sample Variance	7.92	4.457	Kurtosis	-0.369	-0.837
Kurtosis	0.13	-0.815	Skewness	-0.099	-0.113
Skewness	-0.47	-0.591	Range	39.8	37
Range	10	7	Minimum	30	25
Minimum	-2	-3	Maximum	69.8	62
Maximum	8	4	Sum	839	737.5
Sum	49	12	Count	16	16
Count	15	15			

## Discussion

The results showed significant differences between handgrip strength and spatial accuracy, but the mental demands were high and affected by listening to music, which noticeably improved performance. Meanwhile, the handgrip strength, which required high muscular strength, was associated with low cognitive decline. This precisely means that music affected mental concentration more than it affected muscular strength through handgrip strength.

The question of study is why impact of music on concentration accuracy and grip strength can vary based on several psychological and physiological factors. Here are some potential reasons: Psychological Impact. Music can

affect mood and mental focus more than it affects physical strength. Music may help improve attention and concentration by reducing stress and stimulating the mind. Neural Stimulation, music may influence the central nervous system in ways that enhance alertness and vigilance, thereby increasing concentration accuracy. This effect may not be as potent on muscles and physical performance, such as grip strength. Mental vs. Physical Stimulation, music is often used as a tool for mental and emotional stimulation, which can lead to improved performance in tasks requiring mental focus. In contrast, physical stimulation may require other factors like physical exercise or nutrition. Personal Adaptation, individuals may react differently to music based on their personal preferences and past experiences, which may make the impact on concentration more noticeable for some people compared to its effect on physical performance. ( Akhshabi & Rahimi, 2021; Terry et al., 2019 )

There are numerous studies that explore the impact of music on perception and muscle performance in sports. Generally, the music can have a positive effect on athletic performance by influencing psychological and physiological responses such as perception of effort. (Maes et al., 2014; Felszeghy et al., 2023 ) the music has been shown to reduce the perception of effort during physical activities. This means that participant may feel that a hand grip is stronger when listening to music, allowing them to do strong grip and more effectively. Listening to music can enhance motivation and improve mood, which can be particularly beneficial in sports.

These findings highlight the multifaceted role that music can play in sports, affecting both the mental and physical aspects of performance.

Conclusion In sum the musical rhythm enhances performance, whether it requires high physical strength or high mental energy. However, the effect of music on performance that requires high mental energy was greater than on performance that requires great physical strength.

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