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The Effects of Smartphone Use During Resistance Training

Morgan REKSTIS[1] Emily BEACH[1] Taylor CORNELL[1] Mallory S. KOBAK[1] Michael J. REBOLD*[1]

[1]*Department of Integrative Exercise Science, Hiram College, Hiram, USA*

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* **Corresponding Author**:
Michael J. REBOLD
E-mail Address:
reboldmj@hiram.edu

ABSTRACT

Several health risks are associated with sedentary behavior; therefore, it is important to better understand behaviors such as smartphone use and how it may influence physical activity and/or exercise. This study assessed the effects of smartphone use during resistance training (RT) exercise on volume load, intensity, liking, and productivity. Twenty college-age students participated in two separate 30-minute RT workouts (smartphone ALL and smartphone MUSIC) on two different days. One condition was assigned an upper-body workout, while the other condition was assigned a lower-body workout. During the *smartphone ALL* condition, participants were instructed to use their smartphone for any function (e.g., texting, apps, music, etc.). For the other *smartphone MUSIC* conditions, participants were instructed to only use their smartphone for music. There were no significant differences in volume-load and exercise intensity between *smartphone ALL* upper body exercises and *smartphone MUSIC* upper body exercises and *smartphone ALL* lower body exercises and *smartphone MUSIC* lower body exercises ($t \leq 0.59$, $p > 0.05$). There was a significant difference in liking and productivity between *smartphone ALL* upper body exercises and *smartphone MUSIC* upper body exercises and *smartphone ALL* lower body exercises and *smartphone MUSIC* lower body exercises ($t \leq 3.01$, $p \leq 0.01$). In conclusion, using your smartphone for all functions, rather than limiting it to music purposes only, can interfere with RT exercise, resulting in a significant decrease in liking (i.e., enjoyment) and perceived productivity.

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INTRODUCTION

Smartphone use has been found to be positively associated with sedentary behavior (Fennell et al., 2019). Excessive sedentary behavior has been found to result in an increased likelihood of several potentially deleterious health effects, such as cardiovascular disease (CVD), metabolic disease, and type 2 diabetes (Biswas et al., 2015). Due to the health risks associated with sedentary behavior, it is crucial to better understand behaviors such as smartphone use and their potential influence on physical activity and exercise (e.g., RT). Resistance training (RT) is inversely associated with CVD, metabolic disease, and type 2 diabetes (American College of Sports Medicine, 2021). These findings suggest a favorable influence of RT on several chronic diseases and, therefore, should be included in one's weekly engagement in physical activity/exercise, with the American College of Sports Medicine (ACSM) recommending engaging in RT 2-3 $d \bullet wk^{-1}$ (American College of Sports Medicine, 2021). However, many individuals are not meeting the physical activity/exercise and RT guidelines, with only 24.2% of those adults 18 and older meeting both aerobic and RT exercise (CDC National Center for Health Statistics, 2022). According to Peterson (2006), the number one reason why adults 18 and older are not meeting both aerobic and RT exercise guidelines is that they do not have enough time to exercise. There are numerous reasons why people may not have enough time to exercise or meet the physical activity and exercise guidelines, but smartphone use may be a contributing factor. Previous studies have found smartphone use to have a negative impact on several areas of physical activity/exercise (Duke & Montag, 2017; Fortes et al., 2020; Lepp et al., 2013; Rebold et al., 2015; 2019). The following sections will be divided into exercise *productivity*, *cognition*, and *intensity*.

Smartphone use and its effects on *productivity*: One study examined the relationship between smartphone addiction, daily interruptions caused by smartphone use, and work-related productivity (Duke & Montag, 2017). Researchers asked participants to self-report their level of smartphone addiction, the frequency of smartphone interruptions, and their productivity levels. The study found a significant negative correlation between smartphone addiction and self-reported productivity ($r_s = 0.436$, $p < 0.01$). They revealed that individuals with higher smartphone addiction and more interruptions reported lower levels of productivity compared to those with lower smartphone addiction and fewer interruptions (Duke & Montag, 2017). These findings support that frequent smartphone use during work-related tasks decreases overall productivity. While this study did not focus on resistance

training (RT) exercise, it is an important finding because it highlights the general impact of excessive cell phone use on productivity, which can be related to the volume-load completed during RT exercise. Gantois and colleagues (Gantois et al., 2021) investigated the effects of smartphone use on resistance training sessions. Thirty minutes prior to exercise, participants were asked to scroll through their social media apps. Findings revealed that the volume-load was significantly lower ($p = 0.006$) compared to the control condition, which involved watching a 30-minute documentary prior to exercise (Gantois et al., 2021). These findings suggest that using social media on smartphones immediately before exercise may lead to mental fatigue, which can negatively impact performance during resistance training.

Smartphone use and its effects on *cognition*: One study examined the effects of 30 minutes of smartphone texting while completing a cycle ergometer exercise (Rebold et al., 2019). Researchers used the Stroop Test to measure pre- and post-exercise reaction time and accuracy in smartphone and no smartphone conditions. The findings revealed that participants who engaged in texting during aerobic exercise had significantly worse accuracy ($F = 4.97$, $p = 0.003$) from pre- to post-exercise testing. They also found that the no-smartphone condition yielded a significantly better reaction time ($F = 10.16$, $p < 0.001$) from pre- to post-exercise testing (Rebold et al., 2019). These findings suggest that texting during aerobic exercise impairs cognitive performance. While this study also did not focus on RT exercise, it is an important finding because impaired cognition (e.g., mental fatigue) from cell phone use can cause perceived fatigue; therefore; possibly negatively impacting the productivity of RT exercise. Bangsbo (2015) suggested that sports performance can be negatively affected due to the athlete's attention allocation being disrupted during training by smartphone dependence. Sports performance training can be restricted by smartphone dependence through athletes dividing their attention between their smartphones and training, with the majority of their attention being directed towards their smartphones. This concept of dividing attention amongst multiple tasks is known as dual-tasking (MacPherson, 2018) and has been a concept proposed in other investigations that have investigated the effects of smartphone use on exercise (Fortes et al., 2020; Lepp et al., 2013; Rebold et al., 2015; 2019).

Smartphone use and its effects on *exercise intensity*: Fortes et al. (2020) investigated the influence of smartphone use on endurance, power, and swimming performance in high-level swimmers. For eight weeks, immediately before each training session, the control group watched videos about the Olympic games for 30-minutes, while the smartphone group used social media apps for 30-minutes. Findings revealed that swimmers who reported spending

more time on social media had decreased endurance, reduced power output, and lower swimming performance compared to the control group (p = 0.02, p = 0.01, p = 0.01). These findings indicate that excessive cell phone use before exercise has a negative impact on physical performance (Fortes et al., 2020). Similarly, Lepp et al. (2013) investigated the relationship between smartphone use, physical activity, and cardiorespiratory fitness in college students. Findings revealed a significant, negative relationship between total daily smartphone use and VO_2 max (p = 0.047; Lepp et al., 2013). In a study performed by Rebold et al. (2015), the impact of smartphone use on the intensity and liking of a bout of treadmill exercise was examined. Four conditions —control, texting, talking, and music —were administered on separate days in a random order during a 30-minute bout of treadmill exercise. The findings revealed that smartphone use for music yielded significantly higher treadmill speeds ($p \leq 0.008$), increased liking to the exercise ($p < 0.001$), and higher exercise intensity ($p \leq 0.014$). On the other hand, smartphone use for texting and talking yielded a significantly lower ($p \leq 0.04$) average speed than the control and average heart rate was lower (p = 0.04) in the texting when compared to the control, suggesting that texting during aerobic exercise can decrease workload and intensity (Rebold et al., 2015). The research focusing on smartphone use and its effects on exercise are intense in that it provides quality evidence that smartphone use during exercise results in decreased performance. Once again, these studies did not specifically focus on RT exercise but can possibly be connected in that smartphone use during RT exercise can possibly result in decreased productivity.

Overall, the findings from the studies mentioned above strongly support that smartphone use before and during exercise diverts attention and compromises overall productivity, decreases participation in high-intensity exercise, and disrupts physical fitness gains (Duke & Montag, 2017; Fortes et al., 2020; Gantois et al., 2021; Lepp et al., 2013; Rebold et al., 2015; 2019). The purpose of this study is to determine whether full smartphone access during RT exercise reduces the participants' volume load, intensity, liking, and productivity of their workout. We hypothesized that restricting smartphone use to music purposes only would increase volume load, intensity, liking, and productivity.

METHODS

Participants

Twenty recreationally active college-aged participants were recruited to take part in this study. An a priori power analysis was conducted using G*Power version 3.1.9.7 (Faul et

al., 2007) to determine the minimum sample size required. Results indicated the required sample size to achieve 80% power for detecting a medium effect at a significance criterion of $\alpha = 0.05$. Each participant completed two separate, 30-minute RT exercise conditions (*smartphone ALL*, *smartphone MUSIC*) on separate days. The order of the two conditions was counterbalanced, and each participant completed both conditions (i.e., within-subjects design). A counterbalanced design was employed, as participants completed an upper body resistance training (RT) workout in one condition and a lower body RT workout in the other condition (e.g., *smartphone ALL* - upper, *smartphone MUSIC* - lower). All participants had prior RT experience and on average, had been engaged in RT session 3-4 times per week. In addition, they all reported using their smartphone for various functions during RT sessions. Participants were excluded if they did not have access to a gym, did not have a smartphone, or had any contraindications to exercise (e.g., musculoskeletal conditions such as strains). Prior to participation in this study, participants were notified of the risks and benefits and signed an informed consent form. The Hiram College Institutional Review Board approved this study.

Table 1
Average Height, Weight, and Age of All Participants

Physical Characteristics	Females (n = 10)	Males (n = 10)
Height (cm)	163.7±6.66 cm	173.3±10.79 cm*
Weight (kg)	72.61±22.74 kg	76.13±12.59 kg
Age (years)	20.67±0.65 years	23±2.56 years*

Note. All data are means ± SD; *: males significantly greater than females for height and age; $p < 0.05$ for all

Procedures

Participants reported to a gym of their choice on two separate days, with one week in between the two days that they selected to provide a washout period between conditions. During each visit, participants were instructed to complete a 30-minute RT workout under two exercise conditions: smartphone ALL and smartphone MUSIC. Participants were also informed which workout (upper body or lower body) they would be completing for each condition (smartphone ALL or *smartphone MUSIC*). Resistance training (RT) was defined as a form of exercise where external weights provide progressive overload to skeletal muscles to improve power, strength, endurance, or hypertrophy (Haff & Triplett, 2021). Participants were instructed to only use free weights, body weight, and/or circuit machines throughout their workout. Plyometric exercises were prohibited since this is a mode of RT that recreationally active individuals usually do not complete. Participants were also informed that they could self-select their RT workouts (Table 2) because if they were told to adhere to a specific

percentage of their one repetition maximum (1RM), this may have then negatively affected their liking (i.e., enjoyment). During the *smartphone ALL* condition, participants were allowed full access to their smartphones, including music, playing games, searching the web, checking emails, texting, calling, and social media. During the *smartphone MUSIC* condition, participants were allowed to listen to music only and music of their choice. Participants were also instructed to turn off notifications from all other apps. Research personnel allowed participants to self-select the type of music they wanted to listen to. Research personnel allowed participants to self-select the type of music they wanted to listen to because it was believed that if participants were "forced" to listen to a specific type of music, this could have possibly affected their liking (i.e., enjoyment) in a negative way due to them possibly not liking that specific type of music (Stork et al., 2015). Immediately after each condition, participants were instructed to:

1. Indicate whether music was listened to and, if so, what genre of music was most commonly listened to.
2. Indicate the types of smartphone functions used, the frequency of use, and the duration.
3. Indicate the exercises completed, along with the weight, sets, and repetitions.
4. Mark a line on the OMNI resistance exercise scale to indicate the intensity of the workout (intraclass correlation coefficient = 0.69-0.80; Robertson et al., 2003).
5. Mark a vertical line on a 10 cm visual analogue scale, ranging from "do not like it at all" to "like it very much", to rate the liking (i.e., enjoyment) of the workout (intraclass correlation coefficient = 0.80-0.95; Roemmich et al., 2008).
6. Circle a number from 0-10 to indicate the productivity of the workout was. The range was 0-10; 0 = the worst you could perform, and 10 = the absolute best you could perform.
7. After completing both conditions, indicate your preference for the condition (smartphone ALL or smartphone MUSIC).

Table 2
Resistance Training Exercises Completed by the Participants

Free Weights	Machines
Barbell bench press	Lat pulldowns
Dumbbell rows	Leg press
Dumbbell shoulder press	Leg extensions
Dumbbell biceps curls	Leg curls
Triceps push downs	Hip adductions
Barbell squat	Hip abductions
Trap bar deadlift	
Barbell Romanian dead lifts	
Dumbbell calf raises	

Statistical Analyses

All data were analyzed with SPSS version 20.0 (SPSS Incorporated, Chicago IL, USA), with an a-priori α level of ≤ 0.05. Males' and females' physical characteristics (age, height, weight) were compared using independent samples T-tests. Two conditions (smartphone ALL, smartphone MUSIC) conditions (smartphone ALL, smartphone MUSIC), repeated measures ANOVA was used to examine differences in volume load, intensity, liking, and productivity. Post-hoc analysis for all significant main effects were completed using paired samples T-tests with the Benjamini-Hochberg false discovery rate correction (Benjamini & Hochberg, 1995). Additionally, a chi-square analysis was performed to assess any differences in the participant's preference of the two conditions.

RESULTS

Physical Characteristics

Independent samples t-tests revealed no significant differences in males' and females' physical characteristics for height, weight, and age (Table 1).

Smartphone Applications and Music Usage

During the *smartphone ALL* condition, 100% of participants reported using text messaging and social media applications; 35% reported checking their email, 20% reported playing games, and 10% reported talking. On average, participants checked their smartphone 17 times. During the *smartphone MUSIC* condition, 50% of participants reported listening to pop music, 30% to hip-hop, and 20% to rock.

Volume-Load

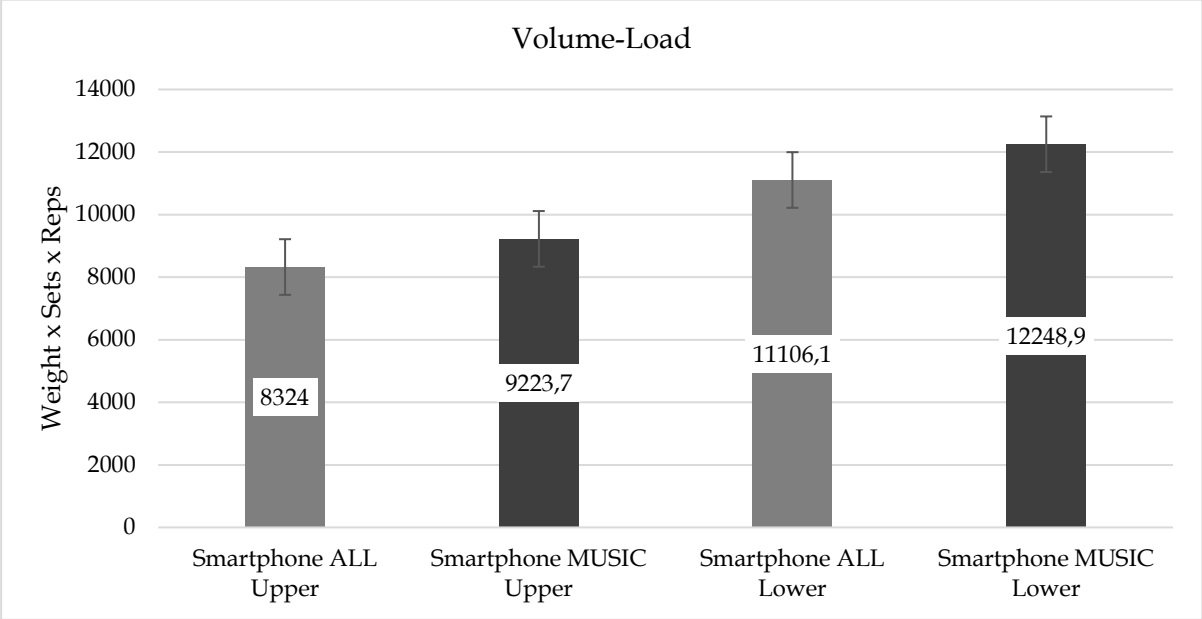
There were no significant differences in volume-load between *smartphone ALL* upper body RT exercises and *smartphone MUSIC* upper body RT exercises and *smartphone ALL* lower body RT exercises and *smartphone MUSIC* lower body RT exercises (d = 0.33, 95% CI, $t \leq 0.88$, $p \leq 0.69$). *Smartphone ALL* upper (8,324 ± 6,065.27) compared to smartphone MUSIC upper (9,223.7±6,929.89); smartphone ALL lower (11,106.1±4,138.89) compared to smartphone MUSIC lower (12,248.9 ± 9,019.26; Figure 1).

Exercise Intensity

There were no significant differences in exercise intensity between *smartphone ALL* upper body RT exercises and *smartphone MUSIC* upper body RT exercises and *smartphone ALL* lower body RT exercises and *smartphone MUSIC* lower body RT exercises (d = 0.21, 95% CI, t

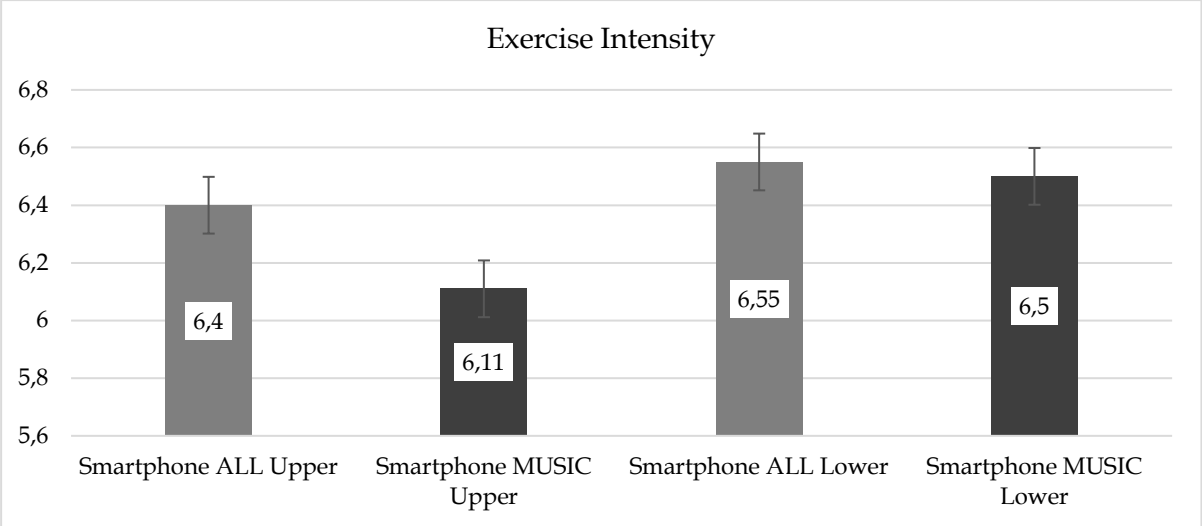
≤ 0.59, $p \leq 0.96$). *Smartphone ALL* upper (6.4±2.07) compared to *smartphone MUSIC* upper (6.11±1.19); *smartphone ALL* lower (6.55±2.51) compared to *smartphone MUSIC* (6.5±1.18; Figure 2).

Figure 1
Results for Volume-Load



Note. The above figure displays results for volume-load from *smartphone ALL* upper body RT exercise, *smartphone MUSIC* upper body RT exercise, *smartphone ALL* lower body RT exercise, and *smartphone MUSIC* lower body RT exercise. All data are means ± SD.

Figure 2
Results for Exercise Intensity

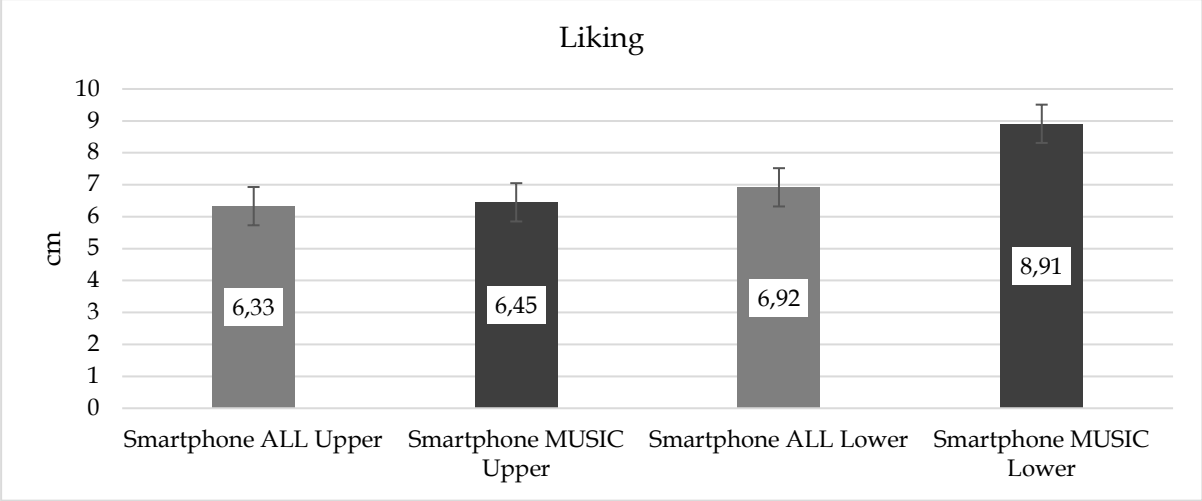


Note. The above figure displays results for exercise intensity from smartphone ALL upper body RT exercise, smartphone MUSIC upper body RT exercise, smartphone ALL lower body RT exercise, and smartphone MUSIC lower body RT exercise.

Liking

There was a significant main effect of the condition for liking (F = 13.03, $p \leq 0.001$). There was a significant difference in liking between *smartphone ALL* lower body RT exercises and *smartphone MUSIC* lower body RT exercises ($d = 0.82$, 95% CI, $t = 3.01$, $p = 0.01$). There was no significant difference between *smartphone ALL* upper body RT exercises and *smartphone MUSIC* upper body RT exercises ($d = 0.22$, 95% CI, $t = 0.12$, $p = 0.91$). *Smartphone ALL* upper (6.33±3.31 cm) compared to smartphone MUSIC upper (6.45±2.09 cm); smartphone ALL lower (6.92±1.67 cm) compared to smartphone MUSIC lower (8.91±1.56 cm; Figure 3).

Figure 3
Results for Liking

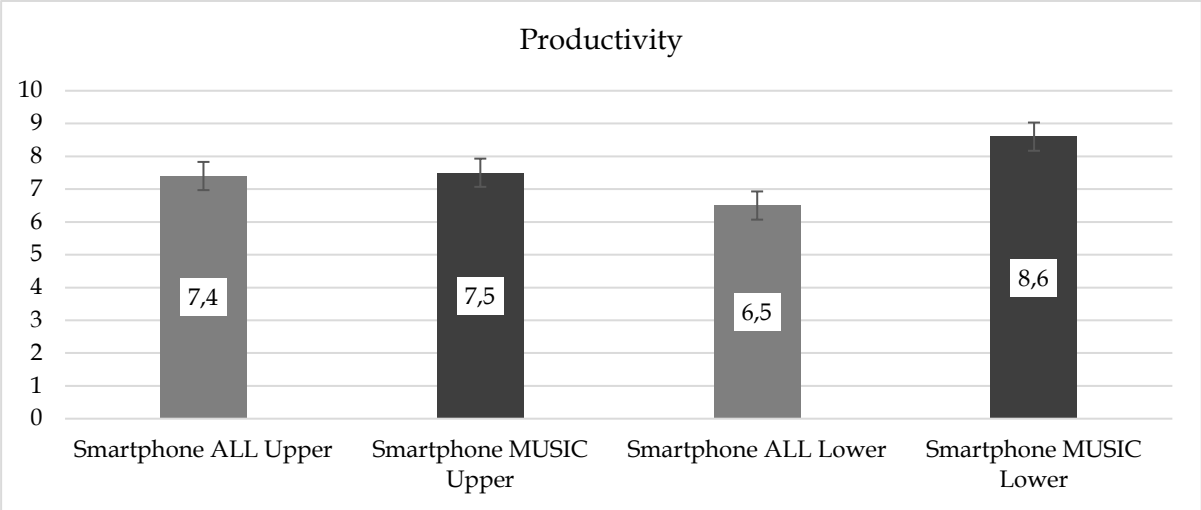


Note. The above figure displays results for liking from smartphone ALL upper body RT exercise, smartphone MUSIC upper body RT exercise, smartphone ALL lower body RT exercise, and smartphone MUSIC lower body RT exercise.

Productivity

There was a significant main effect of the condition for productivity (F = 13.03, $p \leq 0.001$). There was a significant difference in productivity between *smartphone ALL* lower body RT exercises and *smartphone MUSIC* lower body RT exercises ($d = 0.99$, 95% CI, $t = 3.84$, $p \leq 0.001$). There was no significant difference between *smartphone ALL* upper body RT exercises and *smartphone MUSIC* upper body RT exercises ($d = 0.26$, 95% CI, $t = 0.20$, $p = 0.85$). *Smartphone ALL* upper (7.4±2.37) compared to *smartphone MUSIC* upper (7.5±1.96); *smartphone ALL* lower (6.5±1.51) compared to *smartphone MUSIC* (8.6±1.07; Figure 4).

Figure 4
Results for Productivity



Note. The above figure displays results for productivity from smartphone ALL upper body RT exercise, smartphone MUSIC upper body RT exercise, smartphone ALL lower body RT exercise, and smartphone MUSIC lower body RT exercise.

DISCUSSION

This study utilized a within-subjects design to analyze how smartphone use (i.e., texting, social media interactions, etc.) during 30 minutes of RT exercise would affect volume load, intensity, liking, and productivity. Our results were mixed, with significant findings for liking and productivity; however, no significant findings were observed for volume-load and intensity. A possible explanation for the significant findings in both liking and productivity during the *smartphone MUSIC* lower body RT exercises could be that these exercises are generally more intense, leading to greater physical exertion, characterized by increased sweating and rapid breathing, which may give participants a stronger sense of productivity. Furthermore, allowing participants to multitask on smartphones during the *smartphone ALL* lower body RT exercises may have diminished their enjoyment. This reduction likely stems from the challenge of performing complex, multi-joint RT exercises requiring significant neuromuscular control alongside the simultaneous operation of various smartphone functions. It is important to continue to investigate the effects smartphone use has on RT exercise, so further recommendations can be made.

Although previous research has focused on various activities influenced by smartphone use, our results were not entirely dissimilar. Duke and Montag (2017) revealed that individuals with higher smartphone addiction and more smartphone interruptions reported lower levels of productivity compared to those with lower smartphone addiction and

fewer interruptions (Duke & Montag, 2017). This was also observed in the current study, with participants who reported using their smartphone for more functions (e.g., playing games, texting, etc.) reporting significantly lower levels of perceived productivity. This provides evidence that greater smartphone use and interruptions from smartphone functions (e.g., playing games, texting, etc.) can decrease one's level of perceived productivity during an RT workout. In addition, though not significant, there were decreases in both volume load and intensity for the *smartphone ALL* condition when compared to the *smartphone MUSIC* condition.

Rebold and colleagues (2019) investigated smartphone use during cycle ergometer exercise, and their findings suggested that texting during aerobic exercise impairs cognitive performance. Although cognition was not assessed in the current study, previous research has shown that smartphone use can lead to mental fatigue (Gantois et al., 2021). Mental fatigue has been defined as a cognitive condition that occurs after prolonged cognitive activity and is characterized by feelings of fatigue, tiredness, boredom, reluctance to continue the task, increased distractibility, and decreased focus (Boksem et al., 2005). In the current study, although not significant, participants rated their RT workouts as slightly more strenuous in the smartphone ALL condition compared to the *smartphone MUSIC* condition, which may have had an impact on volume-load, productivity, and liking.

A few studies, such as those conducted by Fortes et al. (2020) and Lepp et al. (2013), found that smartphone use during different modes of exercise (e.g., swimming and aerobic exercise) resulted in decreased performance. Our findings are in agreement with these previous studies because our participants had a reduced volume load for both upper and lower RT workouts in the *smartphone ALL* condition when compared to the *smartphone MUSIC* condition. It is important to note, though, our findings were not significant like they were in these previously mentioned studies, which can possibly suggest that smartphone use does not influence RT as much as these other modes of exercise.

Limitations

Provides useful information, it is not without limitations. The participants were all college-aged students who were all accustomed to using smartphones during RT exercise, so we are not able to generalize our findings to other populations (e.g., middle- and older-aged adults) nor to those who are not accustomed to using such devices while engaging in RT exercise. Future research should consider focusing on other populations, such as older adults

and athletes, so we can better understand how smartphone use would affect them while engaging in RT exercise. For example, older adults were not raised entirely in the digital age, so it is possible that there may be more negative outcomes. Another limitation was that participants were allowed to self-select the type of music that they wanted to listen to. The type of music (genre, tempo, and loudness) participants listened to may have influenced their exercise intensity and motivation to complete more work (Edworthy & Waring, 2006). Although one condition was completed each week, future studies should consider monitoring variables such as sleep quality, muscle soreness, fatigue, and/or stress, as these variables may influence RT performance. In addition, identifying participants as low- moderate- or high-frequency smartphone users would possibly provide more insights into how smartphone addiction affects RT performance. Allowing participants to self-select their RT workouts may have influenced volume load and exercise intensity. Future research should consider assessing 1RM and prescribing a specific percentage of 1RM to complete. Finally, participants were exposed to each condition only once. Future studies should focus on introducing a time factor by repeating each condition at least once more. This can offer insights into time-related effects or adaptation trends.

CONCLUSION

Smartphone use has been identified as a distraction during physical activity/exercise and now, RT. Presently, we demonstrated that being allowed to use your smartphone for all functions during an RT session lowered upper and lower body volume load by 10.9% and 10.3%, exercise intensity by 4.5% and 0.76%, liking by 1.9% and 28.76%, and productivity by 1.35% and 32.31%, respectively. Organizations such as the ACSM and National Strength and Conditioning Association (NSCA) advocate the importance of RT exercise because higher levels of muscular strength are associated with a significantly better cardiometabolic risk profile, lower risk of developing physical limitations, improvements in body composition, and enhances bone mass, therefore; improving independence and quality of life (American College of Sports Medicine, 2021; Haff & Triplett, 2021). It is for these reasons that smartphone use should be limited during RT exercise to music purposes only so one can achieve the previously mentioned guidelines and reap the benefits of RT exercise.

In conclusion, it appears that using your smartphone for a variety of different functions while not limiting it to music purposes only during a RT workout has the potential to interfere

with volume load, intensity, liking, and productivity. If one wants to maximize the benefits of RT exercise, it is recommended to only use your smartphone for music purposes only.

PRACTICAL IMPLICATIONS

Resistance training offers numerous health and fitness benefits, including reducing the risk of morbidity and enhancing physical performance. To fully maximize these benefits, it is crucial to be mindful of how smartphones are used during exercise. Currently, using your smartphone solely for music while engaging in RT does not negatively impact performance.

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Authors' Contributions

All authors contributed to the study design; First, second and third authors implemented the study's procedures and collected data. Fourth and fifth authors analyzed the study's data. All author's contributed to the preparation of the study's manuscript.

Declaration of Conflict Interest

All authors have no conflicts of interest to declare.

Ethics Statement

This study was approved by the Hiram College Institutional Review Board on October 3rd, 2023.

REFERENCES

American College of Sports Medicine. (2021). *ACSM's Guidelines for Exercise Testing and Prescription*. Philadelphia, PA: Lippincott Williams & Wilkins.

Bangsbo, J. (2015). Performance in sports – with specific emphasis on the effect of intensified training. *Scand J Med Sci Sports*, *25*, 88-99.

Benjamini, Y., & Hochberg, Y. (1995). Controlling the false discovery rate: a practical and powerful approach to multiple testing. *J R Stat Soc Series B*, *57*(1), 289-300.

Biswas, A., Oh, P. I., Faulkner, G. E., Bajaj, R. R., Silver, M. A., Mitchell, M. S., & Alter, D. A. (2015). Sedentary time and its associated with risk for disease incidence, mortality, and hospitalization in adults: a systematic review and meta-analysis. *Ann Intern Med*, *162*(2), 123-132.

Boksem, M. A. S., Meijman, T. F., & Lorist, M. M. (2005). Effects of mental fatigue on attention: an ERP study. *Brain Res Cogn, 25*(1), 107-116.

CDC National Center for Health Statistics. *Exercise or Physical Activity*. Published December *15,* 2022. Retrieved January 20, 2024.

Duke, É., & Montag, C. (2017). Smartphone addiction, daily interruptions and self-reported productivity. *Addict Behav Rep, 6*, 90-95. https://doi.org/10.1016/j.abrep.2017.07.002

Edworthy, J., & Waring, H. (2006). The effects of music tempo and loudness on treadmill exercise. *Ergon, 49*(15), 1597-1610.

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behav Res Methods*, *39*, 175-191. https://doi.org/10.3758/BF03193146

Fennell, C., Barkley, J. E., & Lepp, A. (2019). The relationship between cell phone use, physical activity, and sedentary behavior in adults aged 18-80. *Comput Human Behav*, *90,* 53-59. https://doi.org/10.1016/j.chb.2018.08.044

Fortes, L. S., Nakamura, F. Y., Lima-Junior, D., Ferreira, M. E., & Fonseca, F. S. (2020). Does social media use on smartphones influence endurance, power, and swimming performance in high-level swimmers? *Res Q Exercise Sport*, *93*(1), 120-129. https://doi.org/10.1080/02701367.2020.1810848

Gantois, P., de Lima-Junior, D., de Sousa Fortes, L., Batista, G. R., Nakamura, F. Y., & de Souza Fonseca, F. (2021). Mental fatigue from smartphone use reduces volume-load in resistance training: a randomized, single-blinded cross-over study. *Percept Mot Skills*, *128*(4), 1640-1659.

Haff, G., & Triplett, N. T. (2021). *Essentials of Strength Training and Conditioning*. Champaign, IL: Human Kinetics.

Lepp, A., Barkley, J. E., Sanders, G. J., Rebold, M., & Gates, P. (2013). The relationship between cell phone use, physical and sedentary activity, and cardiorespiratory fitness in a sample of U.S. college students. *Int J Behav Nutr Phys Act*, *10*(1), 79. https://doi.org/10.1186/1479-5868-10-79

MacPherson, S. E. (2018). Definition: dual-tasking and multitasking. *Cereb Cortex*, *106,* 313-314. https://psycnet.apa.org/doi/10.1016/j.cortex.2018.06.009

Peterson, J. A. (2006). Take ten: take-and-save: ten (lame) reasons people commonly give for not exercising. *ACSMs Health Fit J, 10*(1), 44.

Rebold, M. J., Kobak, M. S., Croall, C. A., Cumberledge, E. A., Dirlam, M. T., & Sheehan, T. P. (2019). The impact of cell phone texting during aerobic exercise on measures of cognition. *Int J Exerc Sci*, *12*(5), 646-656. https://digitalcommons.wku.edu/ijes/vol12/iss5/9

Rebold, M. J., Lepp, A., Sanders, G. J., & Barkley, J. E. (2015). The impact of cell phone use on the intensity and liking of a bout of treadmill exercise. *PloS one*, *10*(5). https://doi.org/10.1371/journal.pone.0125029

Robertson, R., Gross, F., Rutkowski, J., Lenz, B., Dixon, C., Timmer, J., Frazee, K., Dube, J., & Andreacci, J. (2003). Concurrent validation of the OMNI perceived exertion scale for resistance exercise. *Med Sci Sports Exerc*, *35*, 333-341.

Roemmich, J. N., Barkley, J. E., Lobarinas, C. L., Foster, J. H., White, T. M., & Epstein, L. H. (2008). Association of liking and reinforcing value with children's physical activity. *Physiol Behav*, *93*, 1011-1018.

Stork, M. J., Kwan, M. Y., Gibala, M. J., & Martin Ginis, K. A. (2015). Music enhances performance and perceived enjoyment of sprint interval exercise. *Med Sci Sports Exerc*, *47*(5), 1052-1060. https://doi.org/10.1249/mss.0000000000000494