Ann Appl Sport Sci 10(s1): e1120, 2022.
http://www.aassjournal.com; e-ISSN: 2322–4479; p-ISSN: 2476–4981. 10.29252/aassjournal.1120

ORIGINAL ARTICLE

The Effect of Popular Music on Female Students' Fitness in Physical Education Courses

[1]Tuan Tran Minh*

[1]Faculty of National Defense-Security & Physical Education, Saigon University, Hochiminh City, Vietnam.

Submitted February 25, 2022; Accepted in final form April 30, 2022.

ABSTRACT

Background. Music has been seen as a motivator to help individuals who are not persistent enough to do a full set of exercises. However, the effect of long-term using music has not been determined, especially for amateur students who participated in Physical Education courses. **Objectives:** The purpose of the study was to find out the effect of popular music on female physical fitness students when participating in physical education courses. **Methods.** Seventy-three healthy female students were chosen and divided into three groups, of which 24 female students were in the 15-week experimental group, another 24 female students were in the 7-week experimental group, and the 25 female students remaining were in 15-week training without music. The music tempos were classified into three parts of a training session such as the warm-up (90-120 bpm), training (120-150 bpm), and cool-down (60-90 bpm). **Results.** The results indicated that the application of popular music improved speed ($F_{(2,68)}$=13.35, p=0.000), agility ($F_{(2,28)}$=11.93, p=0.000), maximum aerobic speed ($F_{(2,68)}$=4.93, p=0.01), and decreased rating perceived exertion value when compared between the use of music groups and no music in all three sessions (warm-up, training, and cool-down). However, it showed unchanged in the core strength ($F_{(2,68)}$=0.006, p=0.994), power of the legs ($F_{(2,68)}$=0.034, p=0.967), and strength of the hand ($F_{(2,68)}$=0.229, p=0.796). Besides, there was no difference in the effect of music on differences in long-term experimental times between 7-week and 15-week groups in all tests and the rating perceived exertion index, too. **Conclusion.** Long-term using popular music (7e vs. 15e) did not affect female students' fitness in Physical Education courses. However, it can be said that popular music has been a beneficial tool to improve physical fitness and create a dynamic practice environment in physical education courses.

KEYWORDS: ***15-Week Experiment, Female Students, Popular Music, Music Tempo.***

INTRODUCTION

Humans might recognize a song melody converted to a beat frequency pretty quickly and easily. That skill is related to the importance of tone when we pronounce. Even listeners need to be able to hear sounds close to what they pronounce at different pitches, from as early as children (1). Music is considered a great tool (2) for remembering new words to improve reading comprehension. It can be said that music has positive effects on sports activities to enhance sports performance and optimize mobility (3-8). Music in sport is seen as a potential aid to improve mental well-being (9), prolong exercise time (10, 11), and an important tool to stimulate people who have not been in the habit of exercising and participating in low-intensity exercises (12). Based on many previous studies, music enhances endurance and duration of activity when performing physical exercises (13-15) because it can increase the practitioner's interest and distract the central nervous system from feeling tired (16).

*. Corresponding Author:
Tuan Tran Minh, PhD.
E-mail: tmtuan@sgu.edu.vn

One of the proven benefits of music application during exercise was that it improved the mental condition of the practitioner in a positive way, such as increasing interest and mental state in training. Therefore, the music group had a higher exercise heart rate and longer running time on the treadmill than those with no music (17). A meta-analytical study also gave similar results about applying music in sports activities. Therefore, it could be effective in improving the perception of practitioners (RPE), optimizing physical fitness, and enhancing oxygen uptake (18). The main reason for the positive impact of music was that it might help the practitioner more enjoyment and interest during exercise (19, 20), thereby meeting their training needs and optimizing their health benefits (21).

There were many varieties of matters paying attention to concerning the influence of the individual's fitness level on the effectiveness of music and whether music had any impact on participants' physical fitness during training. Besides, music might be used as an indicator to help individuals who are not yet determined enough to complete the intensity of work-out (22). According to a former study, coaches, sports psychologists, trainers, and instructors need to pay attention to the use of music to match the nature of the training session and the type of the music (23). Moreover, studies on the long-term effects of music lack scientific evidence to support its positive impact, as shown in the short term. Most studies have performed the application of music in the laboratory and with participants specializing in a particular sports group (18). Thus, more studies are needed to evaluate the influence of music on practitioners in a relatively long-term experimental period and more practical experience for participants (such as applying music in the actual Physical Education courses and assessing the perceived exertion on the training ground).

The Physical Education (PE) curriculum aimed to improve health fitness, basic movement, and sports skills, to develop students' physical fitness and mental well-being in the new age of industrialization. However, the intensity (pressure) of exercises was rather heavy for students (amateur athletes), the teaching methods were academic pedagogical and achievement-oriented, and the repetitive work-out created boredom in PE courses (24). Therefore, it led them to lack motivation and be afraid to practice with students, especially females. The explanation might be laziness or fear of exercise, poor physical fitness, not having a partner to play with, and too demanding teachers. Brewer et al. suggested that teachers and instructors who wanted to enhance the feeling of joy and excitement in practice (such as in PE courses) should include music in any activities (25). However, it was necessary to make adjustments according to the type of exercise and the specificity of the training session. Thus, it requires a "mental stimulation dose" by applying music for students to enhance their creativity in problem-solving and stimulate them back to practice. The question is whether popular music has a good effect on the improvement of amateur female students' fitness in PE courses is our desire in this study.

MATERIALS AND METHODS

Participants. The study was a longitudinal design on three groups – time parallel experimental research with the dependent physical fitness variables. The volunteer and selected participants were 90 healthy female students who attended the PE program at Sai Gon University. All participants joined the training in 15 weeks (equivalent to one semester). Thirty female students were chosen for the 15-week experiment training with music (15e), another 30 female students took the experiment with music for the last seven weeks (7e), and the remaining 30 female students were in the 15-week training (the control group or C). None of the participants had any physical problems, smoking, alcohol use, or medication. They were informed of the test procedures before providing a written consent form to participate. All participants were recommended to continue their daily dietary and physical activity training throughout the study.

Data Collection. Six fitness tests were chosen to determine the physical fitness of female students, such as 30 seconds sit-up test (evaluated the core strength), 30m sprint test (speed), 4x10m Shuttle run test (agility), standing extended jump test (the explosive power of the legs), handgrip strength test (maximum isometric strength of the hand), and 5-min running field test (maximal aerobic speed-MAS). These tests were suitable to evaluate the fitness of amateur athletes by the Ministry of Education & Training (26) and also suited to assess general fitness in Physical Education courses at Saigon University (27), with high validity and reliability. Besides, the Rating of Perceived Exertion (RPE) scales by Borg (28) were used to evaluate the intensity of training

sessions among three sessions (warm-up, training, and cool-down) after the experiment.

Procedures. Two weeks before the experiment, each participant answered a brief baseline questionnaire about their personal information, training habits, and sport-related injury history. Besides, all participants got acquainted with the fitness tests and how to implement them. In addition, they did not experience daily exercise with music. One week after that, all participants came to examine their fitness before the PE program began. All testing procedures were performed by the same examiner (principal investigator) for better trustworthiness of results. Students were advised not to eat at least 2 hours and not to exercise at least 24 hours before the testing. The procedures followed were ethical for humans in compliance with the 1964 Helsinki Declaration and later amendments.

After that, all participants underwent the 15-week training program in Physical Education course with the same condition, time for studying, and facility use. PE courses took part in the morning (from 9.00 to 10.40 am) on Monday, Tuesday, and Wednesday, corresponding to each group as 15e, 7e, and C, respectively (one time per week). Type of exercises in PE courses at Saigon University were distance running, rope jumping, and barehand activities. Moreover, the 7th week was the mid-term examination and the 15th week was the final exam. We took the experiment in group 7e only for seven weeks. The schedule of using music in each group describes in Figure 1.

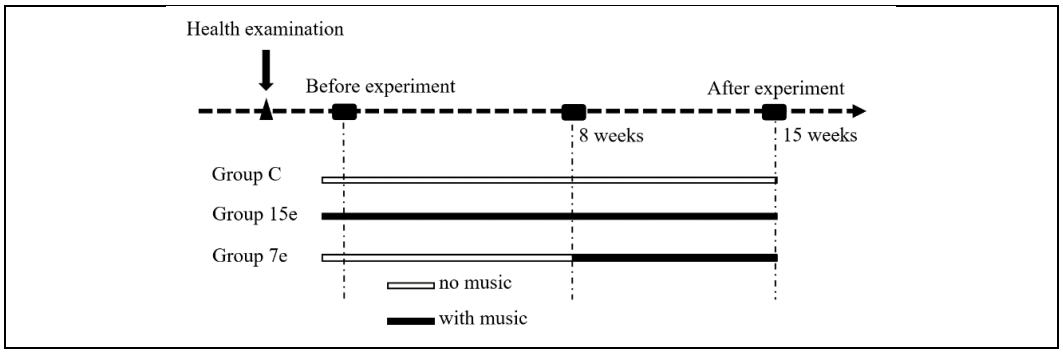

Figure 1. The Research Design of the Study. C: the control group (without music), **15e:** the 15-week experimental group (with music), **7e:** the 7-week experimental group (with music).

Table 1. The Application of Popular music in Physical Education Courses.

No.	Activities	Times	Applied Popular Music
1	Class announcement, checking attendance	5 mins	X
2	Warm-up	15 mins	Warm-up music
3	Short break	5 mins	X
4	Physical fitness training*	20 mins	Training music
5	Long break	10 mins	X
6	Physical fitness training*	25 mins	Training music
7	Short break	5 mins	X
8	Cool-down	10 mins	Cool-down music
9	Evaluation after training	5 mins	X
	Summary	**100 minutes**	**70 minutes**

* Aerobic training, sprint exercises, jumping rope, exercise with bare hands and/or sticks, agility training, resistance training with or without heavyweights.

The software used to check the tempo of songs (beats per minute - bpm) was the "Metronome" application (which would take free download for Mac or Windows). The type of song in this study was popular music (also called light music, pop music). All songs were chosen with a vibrant beat and joyful rhythms, creating excitement in listeners. Physical Education courses at Saigon University conducted one session per week (100 minutes per session). The application of popular music in one session describes in Table 1.

Therefore, the music tempo would range from 90-120 bpm in the warm-up section, 120-150 bpm in training, and 70-90 bpm in cool-down. All of the popular songs were selected for non-profit purposes, not advertised or recommend for any reason, and

only used in the experiment process of this research. In this study, the author tried to apply music in all PE activities, except for the periods for checking attendance, breaks, and evaluation after training. JBL Party box 300 speaker was used to play all popular songs in this study, which was possible to connect two speakers (more than 300W power if necessary) when conducting the practice in a broad actual training ground at Saigon University. Popular songs were played randomly but with an increasing orientation in the song tempo. Besides, it also met the increase of exercises intensity due to the differences in training activity (warm-up, training, or cool-down). Some examples of the popular songs in the warm-up session (song name - artist - music tempo) were How long-Charlie Puth-110 bpm, Lights-Ellie Goulding-120 bpm, Nimbus into the wild-Nokyo-110 bpm, The subway song-Delacey-108 bpm. Popular songs in training were Every time we touch-Cascada-142 bpm, Firework-Katy Perry-125 bpm, Higher ground-Remady-130 bpm; I like to move it-Cardio workout-135 bpm. Moreover, popular songs in cool-down were Not easy-Ambassadors-84 bpm, Stitches-Shawn Mendes-75 bpm, Treat you better-Shawn Mendes-83 bpm, Winding road-Bonnie Somerville-81 bpm.

At the end of the 15-week training in PE courses, all participants underwent the fitness evaluation (including 06 fitness tests) with the same examiner for each PE course.

Statistical Analysis. All data were expressed as mean and standard deviation values (mean±SD). Data collections were analyzed by using SPSS for Windows version 20. The ANCOVA was used to determine the differences in fitness tests among three groups (15e, 7e, and C), with Bonferroni post hoc test adjustment. One-way ANCOVA was used to examine the differences in RPE index among three groups. A p-value of less than 0.05 was determined to be a significant difference. Values were presented in mean ± standard deviation.

RESULTS

Some participants were excluded from the experiment because of the drop-out, health problems, and personal problems. Therefore, 73 female students remaining among three groups (15e, 7e, and C) continued the experiment until the end of the 15-week training in PE course at Saigon University. The average age, height, and weight in group C (n=25) were 18.32±0.48 years, 156.44±4.63 cm, and 48.36±3.68 kg, respectively; while in group 7e (n=24) were 18.21±0.41 years, 156.58±6.36 cm, and 47.21±7.34 kg respectively, as well as in group 15e (n=24) were 18.33±0.48 years, 158.42±5.17 cm, and 49.14±6.83 kg respectively. Besides, mean values in female students' fitness before and after the experiment are presented in Table 2.

Table 2. Mean Values of Fitness Level in Three Groups before and after the Experiment

Fitness Tests / Times	Groups			Levene's Test (Sig.)
	C	7e	15e	
Handgrip strength (kg)				0.322
Pre-test	26.1±2.04	26.23±2.06	26.19±1.95	
Post-test	27.46±2.48	27.63±2.55	27.57±2.35	
30s sit-up (times)				0.226
Pre-test	14.88±1.39	14.83±1.4	14.88±1.39	
Post-test	16.24±1.61	16.25±1.57	16.29±1.49	
Standing long jump (cm)				0.103
Pre-test	158.48±8.54	157.17±11.18	157.25±12.54	
Post-test	164.48±7.9	163.33±8.75	164.17±11.7	
30m sprint (s)				0.071
Pre-test	6.31±0.26	6.38±0.33	6.32±0.32	
Post-test	6.02±0.35	5.76±0.4	5.75±0.4	
4x10m Shuttle run (s)				0.509
Pre-test	13.2±0.39	13.24±0.52	13.22±0.35	
Post-test	12.91±0.4	12.64±0.4	12.65±0.38	
5-min running field (m)				0.546
Pre-test	730.4±42.08	727.92±43.93	729.58±43.89	
Post-test	836.4±78.2	879.17±60.1	886.67±77.1	

C: the control group (without music), **15e:** the 15-week experimental group (with music), **7e:** the 7-week experimental group (with music)

Table 3 shows the test of the between-subjects effect and pairwise comparison. Table 3 showed that all fitness tests had the Sig. in the source "pre-test" lower than 0.05. It means that the differences in the pre-test have a significant effect on the experimental manipulation (the impact of using

popular music on the final score). Moreover, there were significant differences in 30m sprint test ($F_{(2,68)}$=13.35, p=0.000), 4x10m shuttle run test ($F_{(2,28)}$=11.93, p=0.000), and 5-min running field test ($F_{(2,68)}$=4.93, p=0.01); however, the significant differences only between the 2-group using music (15e, 7e) and the control group (no music).

Furthermore, there were no significant differences in handgrip strength test ($F_{(2,68)}$=0.006, p=0.994), 30 seconds sit-up test ($F_{(2,68)}$=0.034, p=0.967), and standing long jump test ($F_{(2,68)}$=0.229, p=0.796) among three groups (15e, 7e and C). Besides, there were no significant differences between the two groups using music (15e vs. 7e) in all fitness tests. Table 4 shows the differences in RPE index after the experiment in three groups.

Results in Table 4 showed significant differences in the RPE index between the two groups using music (7e and 15e) and the control group (no music). However, there were no significant differences in RPE between the two groups with music (15e and 7e).

Table 3. Tests of between-Subjects Effect and Pairwise Comparison.

Tests / Source	Sum of Squares	df	Mean Square	F	Sig.	Pairwise comparison (Post-test)		
						C-7e	C-15e	7e-15e
Handgrip strength (kg)						ns	ns	ns
Pre-test	305.556	1	305.56	178.3	0.000			
Group	0.019	2	0.01	0.006	0.994			
30s sit-up (times)						ns	ns	ns
Pre-test	119.185	1	119.185	161.78	0.000			
Group	0.05	2	0.025	0.034	0.967			
Standing long jump (cm)						ns	ns	ns
Pre-test	5209.92	1	5209.925	285.991	0.000			
Group	8.36	2	4.178	0.229	0.796			
30m sprint (s)						***	***	ns
Pre-test	6.51	1	6.510	115.448	0.000			
Group	1.5	2	0.753	13.35	0.000			
4x10m Shuttle run (s)						***	***	ns
Pre-test	6.92	1	6.916	121.656	0.000			
Group	1.356	2	0.678	11.929	0.000			
5-min running field (m)						**	*	ns
Pre-test	2907650.83	1	2907650.83	1695.38	0.000			
Group	16892.18	2	8446.09	4.925	0.010			

C: the control group (without music), **15e:** the 15-week experimental group (with music), **7e:** the 7-week experimental group (with music), **ns:** no significant difference, ***, **, ***:** Significant differences at level of 0.05, 0.01, 0.001, respectively.

Table 4. Mean Differences in Female Students' RPE among Three Groups

Types of activity	Groups			Pairwise comparison		
	C	7e	15e	C-7e	C-15e	7e-15e
Warm-up	13.12±0.93	12.25±0.85	12.21±0.93	*	*	ns
Training	19.04±0.68	17.38±0.88	17.42±0.93	**	**	ns
Cool-down	12.08±0.64	10.96±0.75	11.04±0.69	**	**	ns

C: the control group (without music), **15e:** the 15-week experimental group (with music), **7e:** the 7-week experimental group (with music), **ns: no significant difference, *, **: Significant differences at level of 0.05, 0.01, respectively.**

DISCUSSIONS

The result of this study indicated that the application of popular music showed a speed improvement (30m sprint test), agility (4x10m shuttle run test), and MAS (5-min running field test) in female students after participating in PE courses. Music enhanced endurance and duration of activity when performing exercises (13, 14, 29). Cole & Maeda showed an increase in achievement in the 12-minute Cooper run in healthy females (not in males) when compared between the application of music and no music group (30). Terry & Karageorghis indicated that music might help participants exercise for a longer time (31). Music was a potential aid to improve mental well-being and an important tool to stimulate people who have not been in the habit of exercising and participating in low-intensity exercises (12). It can be said that listening to music makes exercise more enjoyable and motivates the practitioner to reach their goals more efficiently (32). Therapeutic use of the high tempo and vibrant

music might affect central nervous system reflexes, produce physiological arousal responses, and stimulate the intensity of physical activity (33). When you needed a higher demand for running, the MAS had also increased (34), which means that an increase in MAS would enhance aerobic capacity (35). This explained the reason in this study why the speed, agility, and MAS indexes showed higher achievement in the music groups than in the control one. Silva et al. experimented with using music (favorite and non-favorite music) in a group of healthy males, which indicated significant improvement in maximum strength of the hand (handgrip strength test) and the durability of muscle strength (Lat-Pulldown test) (36). However, this study showed no significant differences in core strength, the power of the hand, and the strength of legs between the using music groups (15e and 7e) and no music (C). The explanation might come from the type of work-outs in PE courses, which focus on long-distance running, exercises with bare hands, and jumping rope.

Besides, many previous studies classified music in different tempos, e.g., fast music (higher than 140 bpm) and slow music (lower than 90 bpm) (3, 37, 38). The result showed that the fast music group improved achievements compared to the quiet music or no music group. Another study by Rendi et al. also suggested that the type of music applied to sports context should probably focus on the specific sports and the types of movement (7). In this study, the song tempos were divided into three training sessions such as 90-120 bpm in the warm-up, 120-150 bpm in training, and 70-90 bpm in the cool-down. This classification was suitable for female students in the PE courses at Saigon University, which enhanced speed, agility, and MAS, in line with decreased the RPE index in all parts of training sessions.

Another finding in this study was that the effect of popular music was not influenced by the time (7 weeks and 15 weeks) on female students. Most of the former studies have focused on the music application in the laboratory with short-term experiment planning to assess the impact of music on participants (18). In this study, the application of music for female students who participated in PE courses for a relatively long time (experimental in 15 weeks, one time per week, 70 minutes of music experiment). The explanation might come from the characteristic of the participants. They were female non-sports students, did not experience daily exercise with music, and participated only in PE courses. Most of them attended PE courses because it was one of the required modules in the studying curriculum. Although, the application of music in this study has the effect of changing female students' approach to exercise. The long-term experiment had more enjoyment feeling; however, the fitness improvement showed unchanged. It needs more in-depth studies to evaluate the impact of music in the long-term experiment and on many different target groups of gender, level of fitness, and types of activity.

Mohammadzadeh et al. indicated that listening to music during exercise tended to reduce the perception of exercise intensity, reducing exercise stress (22). Research by Nakamura et al. conducted a music experiment on a group of cyclists that showed a significant increase in distance and decreased RPE (39). Many studies gave a similar result in the decreased RPE, such as exercises on the treadmill (40, 41), running until exhausted at 80-85% VO_2max (29), exercise with high intensity in 20 minutes (42), self-regulated activities (43). The explanation might come from the increased interest in the practitioner and distract the nervous system central about the feeling of fatigue (16). This corresponds to the results of the RPE index in this study. The decrease in the RPE index indicated that music had a positive effect on the perception of female students at Saigon University.

However, results from other studies have shown no difference in the RPE index (36, 44-46). Dyrlund & Wininger surveyed the application of music to healthy adult persons, and the type of exercise was running on the treadmill (47). The results showed that the interest improved in the music group, but the RPE index was unchanged between the music group and no music, also reflected in the warm-up content (48). Research by Jebabli et al. showed an improvement in the 6-minute fast running test, but the RPE index was unchanged in both groups (music and no music group) (49). Elvers & Steffens indicated that music could not enhance the achievement performance but increased the higher risk in training, which might increase the RPE index (50). Thus, there were contradictory results in the RPE index; however, it can be explained by the differences in the level of fitness, gender, type of exercise, and the attention ability of participants.

Hutchinson & Karageorghis showed that attention might influence the application of music at

different exercise intensities (51). In high-intensity exercise, they had to have maximum concentration on the task of work-out, which required synchronization of music tempo with each specific type of activity (personalization of music tempo). Besides, attention distraction might reduce the perseverance during training (15) and decrease achievements indirectly. In theory, when the song's melody rang out, it attracted individual attention in many different ways. It might reduce the RPE value, no matter how intense the training and how fast or slow the music tempo was. In addition, many studies have shown that the application of different song tempos did not affect the RPE (44, 52). Therefore, the use of music needs more studies on the ability of attention in participants to explain the changing of RPE value. It requires an assessment of participants' passion and the problem of optimizing the actual conditions during exercise.

Results from another study indicated that music could not enhance aerobic performance or any change in the physiology of supramaximal exercises (53). Therefore, it is hard to make a direct comparison caused there were conflicts in the results obtained from previous studies. The explanation may be due to the difference in characteristics of participants, genders, age, level of fitness, types of music used (such as headphones, speaker), types of examination tests, number of training times, and political and cultural differences. According to Gibbons, if females did not find value in PE courses (such as improved physical fitness took more excitement in training), they would drop out or take a coping way to complete the course (54). This study attempted to find a better way to improve the fitness of female students during PE courses. In general, results confirmed that music increased the excitement mood of female students (by the decreased RPE index), indirectly helping them complete the intensity of exercise in each training session, enhancing their speed, agility, and MAS. The use of popular music can be a beneficial tool to improve the physical fitness of female students in PE courses if used appropriately.

CONCLUSIONS

According to the results, the application of popular music would improve the speed, agility, maximum aerobic speed, and rating of perceived exertion in female students in physical education courses, except for the core strength, the strength of the hand, and strength of legs. It was difficult to identify reasons for the change or lack of change in female students' physical fitness owing to the differences in gender, training program, music usage, music tempos, location of testing (laboratory vs. on court), etc. Besides, the results also indicated that the impact of music was not affected by long-term use (7 weeks vs. 15 weeks). Future studies should evaluate the application of music to many different kinds of activity in the elective sports course and the concentration of participants during the experiment.

APPLICABLE REMARKS

- Female students are often seen as inactive in physical education courses; however, the application of popular music might help them be more active in practice and had many unexpected results to the authors.
- They made the physical education courses come alive in the training process with music and enhanced their physical fitness.
- The current findings may allow educators and coaches to apply popular music in physical classes to improve students' fitness and create an active and fun training environment.

ACKNOWLEDGEMENTS

The author would like to thank all students at Saigon University for their participation in this study.

CONFLICT OF INTEREST

No conflict of interest could be perceived as interfering with the article's publication.

SUPPORT

The author received no financial support for this research, authorship, or article publication.

ETHICAL APPROVAL

All procedures performed in this study were under the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This manuscript has not been published and is not under consideration for publication elsewhere.

REFERENCES

1. Trehub SE, Bull D, Thorpe LA. Infants' perception of melodies: the role of melodic contour. *Child Dev*. 1984;**55**(3):821-830. **doi:** 10.1111/j.1467-8624.1984.tb03819.x **pmid:** 6734320

2. Douglas S, Willatts P. The relationship between musical ability and literacy skill. *J Res Read*. 1994;**17**(2):99-107. **doi:** 10.1111/j.1467-9817.1994.tb00057.x
3. Birnbaum L, Boone T, Huschle B. Cardiovascular responses to music trempo during steady-state exercise. *J Exercise Physiol Online*. 2009;**12**(1).
4. Bishop DT, Karageorghis CI, Kinrade NP. Effects of Musically-Induced Emotions on Choice Reaction Time Performance. *Sport Psychol*. 2009;**23**(1):59-76. **doi:** 10.1123/tsp.23.1.59
5. Fritz TH, Hardikar S, Demoucron M, Niessen M, Demey M, Giot O, et al. Musical agency reduces perceived exertion during strenuous physical performance. *Proc Natl Acad Sci U S A*. 2013;**110**(44):17784-17789. **doi:** 10.1073/pnas.1217252110 **pmid:** 24127588
6. Parker F. Music therapy as a behavior modification for students with severe behavior2019.
7. M. R, Szabo A, Szabó T. Performance Enhancement with Music in Rowing Sprint. *Sport Psychol*. 2008;**22**(2):175-182. **doi:** 10.1123/tsp.22.2.175
8. Terry PC, Karageorghis CI, Saha AM, D'Auria S. Effects of synchronous music on treadmill running among elite triathletes. *J Sci Med Sport*. 2012;**15**(1):52-57. **doi:** 10.1016/j.jsams.2011.06.003 **pmid:** 21803652
9. Bigliassi M, Karageorghis CI, Hoy GK, Layne GS. The Way You Make Me Feel: Psychological and cerebral responses to music during real-life physical activity. *Psychol Sport Exercise*. 2019;**41**:211-217. **doi:** 10.1016/j.psychsport.2018.01.010
10. Maddigan ME, Sullivan KM, Halperin I, Basset FA, Behm DG. High tempo music prolongs high intensity exercise. *PeerJ*. 2019;**6**:e6164. **doi:** 10.7717/peerj.6164 **pmid:** 30643679
11. Thakare AE, Mehrotra R, Singh A. Effect of music tempo on exercise performance and heart rate among young adults. *Int J Physiol Pathophysiol Pharmacol*. 2017;**9**(2):35-39. **pmid:** 28533890
12. Patania VM, Padulo J, Iuliano E, Ardigo LP, Cular D, Miletic A, et al. The Psychophysiological Effects of Different Tempo Music on Endurance Versus High-Intensity Performances. *Front Psychol*. 2020;**11**:74. **doi:** 10.3389/fpsyg.2020.00074 **pmid:** 32116903
13. Schwartz SE, Fernhall B, Plowman SA. Effects of Music on Exercise Performance. *J Cardiopul Rehabilit Preven*. 1990;**10**(9):312-316. **doi:** 10.1097/ 00008483-199009000-00002
14. Crust L. Carry-over effects of music in an isometric muscular endurance task. *Percept Mot Skills*. 2004;**98**(3 Pt 1):985-991. **doi:** 10.2466/pms.98.3.985-991 **pmid:** 15209316
15. De Bourdeaudhuij I, Crombez G, Deforche B, Vinaimont F, Debode P, Bouckaert J. Effects of distraction on treadmill running time in severely obese children and adolescents. *Int J Obes Relat Metab Disord*. 2002;**26**(8):1023-1029. **doi:** 10.1038/sj.ijo.0802052 **pmid:** 12119566
16. Thakur AM, Yardi SS. Effect of different types of music on exercise performance in normal individuals. *Indian J Physiol Pharmacol*. 2013;**57**(4):448-451.
17. Rasteiro FM, Messias LHD, Scariot PPM, Cruz JP, Cetein RL, Gobatto CA, et al. Effects of preferred music on physiological responses, perceived exertion, and anaerobic threshold determination in an incremental running test on both sexes. *PLOS ONE*. 2020;**15**(8):e0237310. **doi:** 10.1371/journal.pone.0237310 **pmid:** 32785289
18. Terry PC, Karageorghis CI, Curran ML, Martin OV, Parsons-Smith RL. Effects of music in exercise and sport: A meta-analytic review. *Psychol Bull*. 2020;**146**(2):91-117. **doi:** 10.1037/bul0000216 **pmid:** 31804098
19. Digelidis N, Karageorghis C, Papapavlou A, Papaioannou AG. Effects of asynchronous music on students' lesson satisfaction and motivation at the situational level. *Teach Physic Educat*. 2014;**33**(3):326-341. **doi:** 10.1123/jtpe.2013-0120
20. Madison G, Paulin J, Aasa U. Physical and psychological effects from supervised aerobic music exercise. *Am J Health Behav*. 2013;**37**(6):780-793. **doi:** 10.5993/AJHB.37.6.7 **pmid:** 24001627
21. Stork MJ, Karageorghis CI, Martin Ginis KA. Let's go: Psychological, psychophysical, and physiological effects of music during sprint interval exercise. *Psychol Sport Exercise*. 2019;**45**:101547. **doi:** 10.1016/j.psychsport.2019.101547
22. Mohammadzadeh H, Tartibiyan B, Ahmadi A. The effects of music on the perceived exertion rate and performance of trained and untrained individuals during progressive exercise. *Facta Univ Series Physic Educat Sport*. 2008;**6**(1):67-74.

23. Simpson SD, Karageorghis CI. The effects of synchronous music on 400-m sprint performance. *J Sports Sci*. 2006;**24**(10):1095-1102. **doi:** 10.1080/02640410500432789 **pmid:** 17115524
24. Tuan TM. Evaluation the level of students' satisfaction after participating the elective sport courses at Saigon University. Proceedings of International Conference on Sport Science, Hochiminh City2019.
25. Brewer L, Barney DC, Prusak KA, Pennington T. Effects of music on physical activity rates of junior high school physical education students. *Physic Educat*. 2016;**73**(4):689-703. **doi:** 10.18666/TPE-2016-V73-I4-7024
26. Ministry of Education & Training. Decision No. 53/2008/QĐ-BGDĐT: In the assessment and classification of the students' fitness. 2008; Ha Noi, Vietnam: Ministry of Education and Training.
27. Tuan TM, Son HT. The development of general physical fitness of female students at Saigon University after participating selective courses of basic soccer, volleyball and basketball. *J Educat Sport Sci*. 2017;**4**(20):36-40.
28. Borg GAV. Psychophysical bases of perceived exertion. *Med Sci Sport Exercise*. 1982;**14**(5):377-381. **doi:** 10.1249/00005768-198205000-00012
29. Ghaderi M, Rahimi R, Azarbayjani MA. The effect of motivational and relaxation music on aerobic performance, rating perceived exertion and salivary cortisol in athlete males. *South Africa J Res Sport Physic Educat Recreat*. 2009;**31**(2):29-38. **doi:** 10.4314/sajrs.v31i2.47589
30. Cole Z, Maeda H. Effects of Listening to Preferential Music on Sex Differences in Endurance Running Performance. *Percept Mot Skills*. 2015;**121**(2):390-398. **doi:** 10.2466/06.PMS.121c20x9 **pmid:** 26447745
31. Terry PC, Karageorghis CI. Psychophysical effects of music in sport and exercise: an update on theory, research and application. In: Psychology Bridging the Tasman: Science, Culture and Practice. New Zealand: Auckland; 2006. 26-30 p.
32. Elliott D, Carr S, Orme D. The effect of motivational music on sub-maximal exercise. *Europe J Sport Sci*. 2005;**5**(2):97-106. **doi:** 10.1080/17461390500171310
33. Karageorghis CI, Jones L. On the stability and relevance of the exercise heart rate-music-tempo preference relationship. *Psychol Sport Exercise*. 2014;**15**(3):299-310. **doi:** 10.1016/j.psychsport.2013.08.004
34. Bellenger CR, Fuller JT, Nelson MJ, Hartland M, Buckley JD, Debenedictis TA. Predicting maximal aerobic speed through set distance time-trials. *Eur J Appl Physiol*. 2015;**115**(12):2593-2598. **doi:** 10.1007/s00421-015-3233-6 **pmid:** 26242778
35. Clemente FM, Silva AF, Alves AR, Nikolaidis PT, Ramirez-Campillo R, Lima R, et al. Variations of estimated maximal aerobic speed in children soccer players and its associations with the accumulated training load: Comparisons between non, low and high responders. *Physiol Behav*. 2020;**224**:113030. **doi:** 10.1016/j.physbeh.2020.113030 **pmid:** 32593751
36. Silva N, Rizardi FG, Fujita RA, Villalba MM, Gomes MM. Preferred Music Genre Benefits During Strength Tests: Increased Maximal Strength and Strength-Endurance and Reduced Perceived Exertion. *Percept Mot Skills*. 2021;**128**(1):324-337. **doi:** 10.1177/0031512520945084 **pmid:** 32721189
37. Barwood MJ, Weston NJ, Thelwell R, Page J. A motivational music and video intervention improves high-intensity exercise performance. *J Sports Sci Med*. 2009;**8**(3):435-442. **pmid:** 24150008
38. Clark IN, Baker FA, Taylor NF. The modulating effects of music listening on health-related exercise and physical activity in adults: a systematic review and narrative synthesis. *Nordic J Music Therap*. 2016;**25**(1):76-104. **doi:** 10.1080/08098131.2015.1008558
39. Nakamura PM, Pereira G, Papini CB, Nakamura FY, Kokubun E. Effects of preferred and nonpreferred music on continuous cycling exercise performance. *Percept Mot Skills*. 2010;**110**(1):257-264. **doi:** 10.2466/PMS.110.1.257-264 **pmid:** 20391890
40. Copeland BL, Franks BD. Effects of types and intensities of background music on treadmill endurance. *J Sports Med Phys Fitness*. 1991;**31**(1):100-103. **pmid:** 1861474
41. Young SC, Sands CD, Jung AP. Effect of music in female college soccer players during a maximal treadmill test. *Int J Fitness*. 2009;**5**(2).
42. Potteiger JA, Schroeder JM, Goff KL. Influence of music on ratings of perceived exertion during 20 minutes of moderate intensity exercise. *Percept Mot Skills*. 2000;**91**(3 Pt 1):848-854. **doi:** 10.2466/pms.2000.91.3.848 **pmid:** 11153860

43. Connon HA, Scott D. The effect of differing types of music and music preference as a dissociative strategy on exercise performance and perceived exertion. *J Exercise Movement Sport (SCAPPS refereed abstracts repository)*. 2011;**43**(1):58.
44. Edworthy J, Waring H. The effects of music tempo and loudness level on treadmill exercise. *Ergonomics*. 2006;**49**(15):1597-1610. **doi:** 10.1080/00140130600899104 **pmid:** 17090506
45. Karow MC, Rogers RR, Pederson JA, Williams TD, Marshall MR, Ballmann CG. Effects of Preferred and Nonpreferred Warm-Up Music on Exercise Performance. *Percept Mot Skills*. 2020;**127**(5):912-924. **doi:** 10.1177/0031512520928244 **pmid:** 32493179
46. Waterhouse J, Hudson P, Edwards B. Effects of music tempo upon submaximal cycling performance. *Scand J Med Sci Sports*. 2010;**20**(4):662-669. **doi:** 10.1111/j.1600-0838.2009.00948.x **pmid:** 19793214
47. Dyrlund AK, Wininger SR. The effects of music preference and exercise intensity on psychological variables. *J Music Ther*. 2008;**45**(2):114-134. **doi:** 10.1093/jmt/45.2.114 **pmid:** 18563969
48. Ballmann CG. The Influence of Music Preference on Exercise Responses and Performance: A Review. *J Funct Morphol Kinesiol*. 2021;**6**(2). **doi:** 10.3390/jfmk6020033 **pmid:** 33917781
49. Jebabli N, Granacher U, Selmi MA, Al-Haddabi B, Behm DG, Chaouachi A, et al. Listening to Preferred Music Improved Running Performance without Changing the Pacing Pattern during a 6 Minute Run Test with Young Male Adults. *Sports (Basel)*. 2020;**8**(5). **doi:** 10.3390/sports8050061 **pmid:** 32403345
50. Elvers P, Steffens J. The Sound of Success: Investigating Cognitive and Behavioral Effects of Motivational Music in Sports. *Front Psychol*. 2017;**8**:2026. **doi:** 10.3389/fpsyg.2017.02026 **pmid:** 29209257
51. Hutchinson JC, Karageorghis CI. Moderating influence of dominant attentional style and exercise intensity on responses to asynchronous music. *J Sport Exerc Psychol*. 2013;**35**(6):625-643. **doi:** 10.1123/jsep.35.6.625 **pmid:** 24334323
52. Smitherman KN. Effect of Music Tempo on Self-Selected Exercise Intensity in Untrained Women: A Proof of Concept Study. 2016. Available from: https://trace.tennessee.edu/ utk_gradthes/4077/.
53. Atan T. Effect of music on anaerobic exercise performance. *Biol Sport*. 2013;**30**(1):35-39. **doi:** 10.5604/20831862.1029819 **pmid:** 24744463
54. Gibbons SL. Meaningful Participation of Girls in Senior Physical Education Courses. *Canadian J Educat Revue canadienne de l'éducation*. 2009;**32**(2):222-244.