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MUSIC AS AN ERGOGENIC RESOURCE: THE INFLUENCE OF MUSIC ON PERFORMANCE DURING THE PRACTICE OF STRENGTH TRAINING AND AEROBIC TRAINING

A música como recurso ergogênico: a influência da música no desempenho durante a prática do treinamento de força e treinamento aeróbico

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Abstract

The aim of this study was to verify whether the use of preferred and non-preferred music during exercise, regardless of musical style, could influence the physical performance of strength and aerobic trainers. This is a cross-sectional study, being a field research with a quantitative character following a descriptive study model, for statistical analysis the Shapiro-Wilk test was used to verify the normality of the data distribution and the ANOVA one-way F test was used to analyze the variance of the variable means and a value was adopted for significant statistical differences ($P \leq 0.05$). The results showed that there was a statistically significant positive difference ($F=7.72$; $p= 0.01$) in physical performance when preferred music was used for strength training in leg press exercises when compared to performing these exercises without the use of music. As for aerobic training, there were no statistically significant differences ($F=3.34$) in physical performance when the exercises were performed while listening to preferred music, non-preferred music or without listening to music.

Resumo

O objetivo desta pesquisa é verificar se a utilização de músicas preferidas e não preferidas durante o exercício, independente do estilo musical, poderiam influenciar no desempenho físico de praticantes do treinamento de força e do treinamento aeróbico. Este é um estudo de corte transversal, sendo uma pesquisa de campo com caráter quantitativo seguindo um modelo de estudo descritivo, para análise estatística utilizou-se para a verificação da normalidade da distribuição de dados o teste de Shapiro-Wilk e o teste F ANOVA one-way foi utilizado para fazer análise da variância das médias variáveis e foi adotado valor para diferenças estatísticas significativas ($P \leq 0,05$). Os resultados mostraram que ouve diferença estatisticamente significativa positiva ($F=7,72$; $p= 0,01$) no desempenho físico quando aplicado músicas preferidas no treinamento de força em exercício Leg press quando comparado a realização destes sem uso de música. Quanto ao treinamento aeróbico, não foram encontradas diferenças estatisticamente significativas ($F=3,34$) no desempenho físico quando os exercícios são realizados sobre audição de músicas preferidas, não preferidas e sem audição de músicas.

Key-words: *Music; Performance; Strength training; Aerobic training.*

Palavras-chave: *Música; Desempenho; Treinamento de força; Treinamento aeróbico.*

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INTRODUCTION

Nowadays, more and more people are practicing physical exercise, either to achieve the body model considered perfect or to improve their health, as well as to improve the performance of athletes (Auweele et al., 1997; Brown et al., 2017; Shephard, 1985), and there are many benefits to having a high level of physical activity and maintaining an active lifestyle (Hafner et al., 2020). According to Matsudo (2006), people who exercise are at a lower risk of developing cardiovascular diseases, and exercising can also have a positive influence on risk factors such as blood pressure, lipoprotein profile and glucose tolerance.

Thus, whether in the search for a healthier life, for aesthetic purposes or for sports performance, many individuals have opted for strength training (ST). Strength training can lead to changes in body composition, gains in strength and muscle hypertrophy, as well as a reduction in fat, improved motor performance and other benefits (Santos et al., 2023). They also seek aerobic training (AT), whether to improve their cardiorespiratory capacity, burn fat, improve endurance or for aesthetic purposes (Mang et al., 2022).

In order to improve physical performance through exercise training or AT, many of its practitioners, whether athletes or not, end up developing strategies and looking for tools to maximize their gains (Silva & Farias, 2013). One of these tools is ergogenics, which are characterized as substances or phenomena that can improve an individual's physical performance (Powers & Howley, 2009).

These resources can be divided into different types, which are nutritional, physical, mechanical, psychological, physiological or pharmacological (Fontana, Valdes, & Baldissera, 2008). Among the different types of this resource, we are dealing specifically with music. This resource is very common in gyms and other training centers, and is often used by men and women, and most often listened to on personal devices (headphones) during training (Hallett & Lamont, 2016). However, few know that music can be considered an ergogenic resource. In this perspective, based on these observations, the aim of the present study is to verify whether the use of preferred and non-preferred music during exercise, regardless of musical style, could influence the physical performance of strength training and aerobic training practitioners.

MATERIALS AND METHODS

Type of study

This was a cross-sectional, quantitative field study (Nelson, Thomas, & Silverman, 2012).

Sample

The sample for this study consisted of 10 men aged between 19 and 30, students on the Physical Education degree course at IFCE, Limoeiro do Norte campus - CE. The inclusion criteria were: to be duly enrolled in the Physical Education degree course; to be aged between 19 and 30; not to have any pathology that would make it difficult to perform the movements requested in the tests; to have a cell phone or other device (mp3 or mp4 player) that could play music and create music lists; to have been practicing some form of physical training for at least 3 months; to have a normal BMI or in the overweight range.

Design

They were divided into three groups, A, B and C respectively. Group A consisted of 5 participants who took the tests while listening to their favorite music; Group B consisted of 3 participants who took the tests while listening to non-preferred music, and Group C consisted of 2 participants who took the tests while not listening to music. The process of determining which group the research participants would be assigned to was done by randomization.

Instruments and procedures

Subjective perceived exertion (PSE) was measured using the Borg scale (1982) adapted by Foster et al. (2001), using the PSE CR-10 scale (Table 1) which was presented and explained individually to the volunteers who took part in the study, who answered before and at the end of the test session. Fox's (1973) protocol was used to assess cardiorespiratory capacity. The ACSM protocol (Liguori, Feito, Fountaine, & Al, 2022) was used to estimate a 1 RM. BMI was calculated by dividing body weight in kilograms by height m-2 squared, as recommended by (Liguori et al., 2022). The equipment used

was: *Embreex* bicycle ergometer, *Emar* bench press and *Flex Fitness Equipaments Evolution* leg press.

After signing the informed consent form, the participants underwent two test sessions. Firstly, the 3 groups underwent test session 1, after which they underwent test session 2. All groups had at least three days of rest before undergoing test session 2. The following describes what was done in each test session. Test session 1 - music selection, at this stage the participants created a list of songs they liked listening to, in the case of group A, and songs they didn't like listening to, in the case of group B, on their cell phones or other devices, such as mp3 or mp4 players, and the like. In addition, the participants recorded 3 styles of music they liked to listen to and recorded the names of the songs in a document. The playlists had to be no more than 30 minutes long.

The following steps were followed in the protocol for estimating the participants' 1 RM: 1- The participant warmed up with 12 submaximal repetitions with a light load on the bench *press* and then on the incline *leg press*; 2- after the warm-up they performed a 10-MR with a starting weight chosen by the participant's own perception, in all they would have four attempts made at intervals of 3 to 5 minutes; 3- 2.5 to 20.0 kg were added to each attempt until they were unable to perform the selected repetition; 4- The last weight successfully lifted was recorded as absolute 1-RM or multiple RM; 5- The Brzycki (1993) equation was used to establish the 1-RM based on the number of multiple repetitions.

In test session 2, the research participants performed exhaustion tests on the bench press and incline leg press, and cardiorespiratory capacity was assessed by listening to the music list they had created according to the group they were in. In this session, the volunteers were asked to perform as many repetitions as they could in three sets of each exercise requested, using 70% of the 1RM, we asked that the exercises be performed following the correct movement pattern. During the assessment of cardiorespiratory capacity, a submaximal load was used on a cycle ergometer to measure VO_2 max, in which the subjects had to pedal after a previous warm-up with a fixed load of 150 watts or 900 kgm/min during a single stage lasting 5 minutes. After 5 minutes, the effort heart rate (effort $_{HR}$) was recorded in order to estimate the VO_2 max-($L.min^{-1}$). It should be noted that all the tests were carried out in the university's weight training laboratory.

To perform the bench press, we instructed the participants to lie on the bench keeping

their glutes in direct contact with the bench, hands in pronation holding the bar a little wider than shoulder width, feet flat on the floor. The volunteer should inhale and lower the bar to their chest, and then exhale when lifting the bar again, always controlling the movement. When performing the inclined leg press exercise, the participant had to sit on the machine with their back fully supported on the backrest with their feet hip-width apart, then the individual was instructed to inhale, release the machine's safety lock and flex their knees to the maximum range of movement, then exhale to start extending their knees.

Statistical analysis

Statistical analysis was carried out using inferential procedures, in which the *Shapiro-Wilk* test was used to verify the normality of the data distribution. The *ANOVA* test was used to analyze the variance of the variable means, in all the tests carried out we assumed $p \leq 0.05$ as the value for a statistically significant difference. Analyses and the creation of tables were carried out using the *Windows* programs *Word* and *Excel*, and the *PAST* - UiO program.

Ethical aspects

The research followed all the recommendations of Resolution 466/2012 of the Brazilian National Health Council, in consideration of respect for human dignity and due protection for participants in scientific research involving human beings. All participants in this research received an Informed Consent Form containing information regarding the nature and procedures carried out for data collection. The research participants also signed a Post-Clear Consent Form, showing the researcher's legal and moral protection, as well as their assertive agreement to take part in the research.

RESULTS AND DISCUSSION

Table 1 - The results obtained from the exhaustion tests performed on the bench press.

	FAVORITE MUSIC (M.P)		**NON-PREFERRED MUSIC (M.N.P)**		**WITHOUT MUSIC (N.M)**		**F-test *ANOVA oneway***	
	Mean	S.D	Mean	S.D	Mean	S.D	F	p
Repetitions 1st series	18	7,6	13	1,33	13	2,12	0,74	0,50
Repetitions 2nd series	13	1,9	10	0,57	10	4,24	3,16	0,10
Repetitions 3rd series	10	2,3	9	0,50	9	3,11	0,42	0,67

Note: SD = Standard deviation; F = ANOVA oneway F-test; * significant value ($p \leq 0.05$).
Source: Own elaboration.

Analyzing the results found in the exhaustion test, using 70% of the 1-RM of the individuals evaluated. Using the oneway ANOVA F test, it was observed that for the exhaustion test in the bench press exercise in the first series of the exercise, there was a significant difference in the group that performed the exercise listening to preferred music. This group achieved a higher average number of repetitions than the groups that performed the exercise listening to non-preferred music and without music, with averages of 18 ± 7.6, 13 ± 1.33 and 13 ± 2.12 repetitions, respectively. Despite this difference between means, after statistical analysis we found that because the calculated F values (F= 0.743; F= 3.16; F= 0.420) were lower than the tabulated values, we can say that there was no statistically significant difference between these mean repetitions performed in the first, second and third sets of the exercise

These results do not corroborate those found in the studies by Nakamura, Deustch and Kokubun (2008), who found in their study that the use of favorite music during exercise improves performance. Continuing with the results, table 2 shows the exhaustion tests in the leg press exercise.

Table 2 - Number of repetitions performed during the *leg press* exhaustion test in the groups with preferred music, non-preferred music and no music:

	FAVORITE MUSIC (M.P)		**NON-PREFERRED MUSIC (M.N.P)**		**WITHOUT MUSIC (N.M)**		**F-test *ANOVA oneway***	
	Mean	S.D	Mean	S.D	Mean	S.D	F	p
Repetitions 1st series	17	4,52	14	1,52	10	2,12	2,37	0,16
Repetitions 2nd series	15	3,11	11	2,30	12	4,24	2,13	0,18
Repetitions 3rd series	15	2,16	11	3,21	7	1,41	7,72	0,01*

Note: SD = Standard deviation; F = ANOVA oneway F-test; * significant value ($p \leq 0.05$).
Source: Own elaboration.

After analysis, we observed that for the leg press exercise there was a statistically significant difference in the maximum number of repetitions performed until exhaustion in the third set of repetitions (F=7.72; p= 0.01), where the group that performed the exhaustion test listening to their favorite music showed better results with a mean of 15 ± 2.16 repetitions, when compared to the group that performed the exercise without listening to music. exercise without listening to music, which obtained a mean of 7 ± 1.41 repetitions. These results corroborate those of Silva (2014) in which 20 male and female bodybuilders aged between 18 and 35 performed a session of bodybuilding exercises listening to a playlist created by them. With the results obtained, the authors came to the conclusion that the use of music can improve performance because it makes the individual feel stronger, less tired, and blocks pain stimuli, among other effects caused by the music during the leg press exercise.

We found no significant differences in the first and second sets (F= 2.37; F= 2.13) of the exercise in the maximum number of repetitions performed until exhaustion when comparing the group that performed the exercise listening to their favorite music and the group that performed the exercise listening to their favorite music. which obtained means of 17 ± 4.52 and 15 ± 3.11 and the group that performed the exercise while listening to music they didn't like, with a mean number of repetitions of 14 ± 1.5. repetitions of 14 ± 1.52 and 11 ± 2.3 repetitions.

We agree with the studies by J. Silva and Farias (2013) which consisted of a sample of 5 men (22.5 ± 2.7 years), all with at least six months' experience in exercise training. in exercise training, with all the volunteers carrying out exhaustion tests in the bench press

and front pull-up. and front pull-up where they had to perform the maximum number of repetitions until concentric failure. These exercises were carried out with the subjects listening to a musical with favorite and non-preferred songs previously created by them. They also performed the exhaustion tests without listening to music. performed individually and at different times. The results obtained by the authors showed that the musical selection (preferred and non-preferred songs) did not influence the physical performance of the individuals. Table 3 shows the results obtained in the VO2max cardiorespiratory test.

Table 3 - Results obtained in the assessment of cardiorespiratory capacity:

	FAVORITE MUSIC (M.P)		**NON-PREFERRED MUSIC (M.N.P)**		**WITHOUT MUSIC (N.M)**		**F-test *ANOVA oneway***	
	Average	D.P	Average	D.P	Average	D.P	F	p
VO_2 max.(L.min)$^{-1}$	2,51	0,233	2,26	0,160	1,92	0,305	3,34	0,09

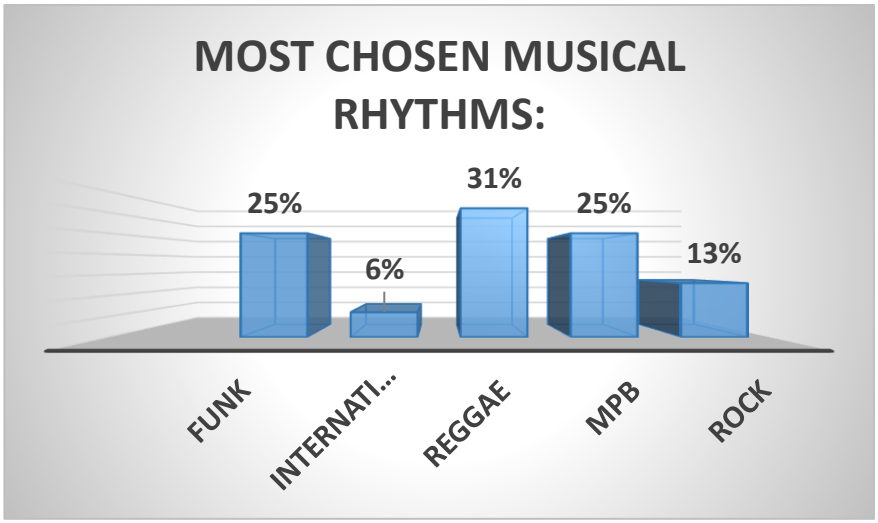
Note: VO2max.(L.min-1) = Maximum Oxygen Volume in Liters per Minute; SD = Standard Deviation; p = Level of Significance ($p \leq 0.05$). Significance level ($p \leq 0.05$).
Source: Own elaboration.

In the results obtained from the VO2max test, the group that performed the test while listening to their favorite music listening to their favorite music obtained a slightly higher mean (2.51 ± 0.23 L.min-1) compared to the group that performed the test with non-preferred music (2.26 ± 0.16). 0.16) and the group that performed the test without listening to music (1.92 ± 0.30) but the differences were not significant (F=3.34).a ($p \leq 0.05$).

The results found here do not corroborate the study carried out by Miranda and Souza (2009) with 85 elderly people aged between 60 and 84 (68.32 ± 4.61), all independent and physically active, who were divided into 3 groups where one group performed aerobic exercises listening to pleasant music, another with unpleasant music, The results obtained in this study showed that with the use of music, whether pleasant or not, there was a reduction in the participants' perception of effort, diverting the focus from the feeling of tiredness and thus contributing to their physical performance during aerobic exercise.

The following shows the musical rhythms most chosen by the group that took the tests with non-preferred songs (figure 1) and the preference in musical rhythms of the group that took the tests with preferred songs (figure 2).

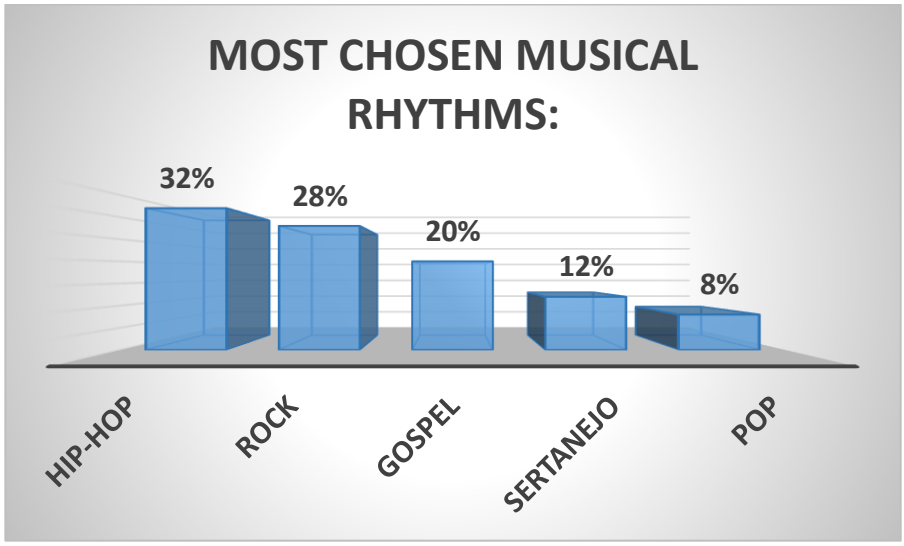
Figure 1 - Preference for musical rhythms of the group that took the tests with non-preferred music.



Source: Own elaboration.

The graph above shows that the rhythms most chosen by the group that took the tests listening to non-preferred music were Reggae with a choice rate of 31%, followed by Brazilian Popular Music (MPB) and Funk, both with a choice rate of 25%. Lastly, the rhythms least chosen were rock music with a 13% choice rate and international music with 6%. Figure 2 shows the musical rhythms most chosen by the group that took the tests on listening to their favorite music.

Figure 2 - Preference for musical rhythms of the group that took the tests with their favorite songs.



Source: Own elaboration.

It can be seen from the data presented in the graph that the group who took the tests listening to their favorite songs mostly opted for songs with a Hip-Hop rhythm with a choice rate of 38%, Rock with 28% and Gospel with a choice of 20%. The least chosen rhythms were country music with a 12% choice rate and pop with 8%. After analyzing the

chosen rhythms shown in graphs 1 and 2, we noticed that the group that took the tests with non-preferred songs tended to choose songs with a slower tempo, while the group that took the tests with preferred songs mostly chose songs with a fast rhythm.

According to the study by Ferguson, Carbonneau, and Chambliss (1994), songs with a faster tempo provide positive stimuli to improve physical performance during exercise, while slower songs, according to the authors, cause negative stimuli that limit physical performance during exercise. Our results do not corroborate those of the aforementioned authors, given that in the exhaustion and cardiorespiratory assessment tests carried out in our study there were no differences in the results when comparing the group that carried out the tests listening to preferred music and the group that carried them out listening to non-preferred music, which leads us to think that the fact that the music was slow or fast may not have had a significant influence on the individual's physical performance during exercise.

CONCLUSION

After looking at the results above, we understand that there can be an improvement in physical performance when listening to preferred music during aerobic training exercises that focus on the lower limbs, as in our case the leg press exercise. The use of music does not seem to generate significant changes in the improvement of physical performance during the practice of aerobic training, either with the use of preferred music, non-preferred music or at times without music. It is likely that in order to verify more effectively how musical preference can influence the practice of ST and AT, another form of experimental design will be necessary, providing tighter control of the variables, the randomization of the sample, the selection of songs, or even the instruments used. Before concluding, we would like to stress the need for new studies on this subject to be encouraged and carried out, in order to contribute more and more to scientific progress in this area of research.

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