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Gender Differences in Psychophysiological Responses to Music Listening

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Abstract

This study presents a comparative account of psychophysiological responses to music listening in healthy males and females. The stimulus material was a slow-paced taped rāga *Desi-Todi* on a flute. The participants listened to music for 30 minutes a day, for 20 days. Pre- and post-treatment procedure was adopted for assessments on psychophysiological measures. The study supports the following conclusions: (1) music listening produced significant decreases in the blood pressure (both systolic and diastolic) and heart rate of females, but had no significant effect in males; (2) music listening reduced stress, anxiety and depression, enhanced life satisfaction, optimism and hope, and was perceived as making life more meaningful in males and females; (3) the effects of music listening, that is, reduction in negative affect, enhancement of positive affect (except the 'hope' scores), and decrease in blood pressure and heart rate, were more intense in females than males.

Keywords: ***music listening, gender differences, psychophysiological responses, negative affect, positive affect, blood pressure, heart rate***

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Music has a tremendous influence on listeners, and it influences them in profound ways [1]. Emotional responses to music listening may lie in complex interactions among a wide array of factors associated with the music, the listener, and the context [2,3]. While exploring psychological and neurobiological mechanisms through which music can influence health and well-being, Juslin and associates, following a multi-method approach, suggested a theoretical framework that in addition to cognitive appraisal includes seven mechanisms, namely, brain-stem reflexes, rhythmic entrainment, evaluative conditioning, contagion, visual imagery, episodic memory, and musical expectancy [4-6] by which music might induce emotions. These mechanisms may be helpful not only in understanding but also identifying the factors that are related to music-induced emotions.

Health professionals and psychiatrists, working in a medical model, have their primary focus on remedying the deficits and disability. The main mode of their intervention has been the repair of damage. The major focus in research on mental health has been on alleviating stress, anxiety and depression. Hence, a great deal of research has been carried out on these negative aspects of behavior within the framework of pathology [7-11]; but the portrayals of humankind within the pathology perspective seem incomplete. No person is entirely positive or negative in functioning. Understanding of the positive as well as the negative is integral to understanding the human condition. Treatment is not just fixing what is broken, it is also nurturing what is best within ourselves [12]. Pathologizing does not move us closer to the prevention of serious disorders [12]. The major strides in prevention are possible if adequate attention is directed toward promoting the competence of individuals by focusing on human strengths which also serves as buffers against mental illness. Moreover, there is a negative relationship between the positive and negative aspects of behavior [13,14]; if one increases the other decreases, the increase or decrease may not be in proportionate magnitude.

In a recent study [15] the impact of music listening was investigated on various indices related to psychophysiological health in male coronary patients and healthy controls. The findings of this study, as reported by the authors, indicated that music listening significantly reduced stress, anxiety and depression and significantly enhanced certain indices of well-being (life satisfaction, optimism, hope and meaning in life) in both coronary patients and healthy controls, and caused significant decreases in blood pressure and heart rate in coronary patients; the effects on all measures related to psychophysiological health and well-being were, however, more intensified in coronary patients compared to healthy controls. The findings related to the effects of music listening

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on the positive aspects of behavior in this study need confirmation. More concerted efforts are also needed to study the impact of music on the positive aspects of behavior, also known as human strengths, such as optimism, hope, life satisfaction, self-efficacy, meaning and purpose in life, wisdom, perseverance, courage, generosity, and altruism, to name a few, in clinical populations as well as healthy persons. Investigating the impact of music listening on the positive aspects of behavior is important in itself because individuals spend a significant amount of time and energy structuring their lives in ways that facilitate positive feelings and emotions [16].

Listeners generally use music as a mood regulator. Emotional regulation has often been reported as one of the major reasons for listening to music [17-20]. Participants listen to music primarily to manage or regulate their moods, and that the reasons for listening to music may change as people grow older [21]. Mood improvements have also been observed in stroke patients after intensive music listening or music performance training in motor neurorehabilitation protocols [22,23]. Music listening perhaps "activates attention, semantic processing, memory, motor functioning and emotional processing, and enhances emotional and cognitive functioning in healthy subjects and in various clinical patient groups" [24(p. 866)]. It has been rightly suggested that music is a tool that can be used to "enact micro-practices" that can influence an individual's regulatory functions, such as emotions [25(p.2)].

Musical engagement positively strengthens one's social bonds with others [26-28]. Recent studies have shown that shared music preferences create deep social bonds across individuals, increasing social attraction among them [21,29]. Music also facilitates social interactions and interpersonal relationships [29,30]. Actively listening to soothing music can increase a listener's level of oxytocin [31], a neuropeptide that plays a central role in the formation of social attachment and relationships in humans [32].

Gender-related differences in physiological responses to music, investigated by a wide array of psychophysiological assessments, have been reported [33]. In this study, women displayed heightened physiological reactions to heavy metal stimuli (hard rock music) than men [33]. In another study, music led to a greater temperature decrease in women than men [34]. Music-induced frisson is more likely to be reported by female listeners than by male listeners [35]. It has been reported that women prefer classical music more than men (who show preference for hard rock/heavy metal) [33]. Women use music to "influence emotions" to a larger extent than men [36], this finding is consistent with findings from studies of adolescents [37,38]. Women display more use of music for regulation of emotion than men [36]; they also listen to music for health benefits to a larger extent than men [36]. However, no systematic effort has been made to study gender-related differences in psychological responses to music listening on parameters related to mental health and well-being.

In the present study rāga *Desi-Todi*, a sort of slow-paced music that consists of a series of repetitive notes or beats [39,40] played on a flute without lyrics as well as without tabla by a renowned musician, Hari Prasad Chaurasia, was used. Such slow-paced and repetitive music can act like a *mantra* and induce a meditative state of relaxation [39]. This rāga has been advocated to be appropriate for late morning, i.e., between 7 a.m. and 10 a.m. In Indian music there are rāgas that are specifically played upon instruments or sung in the morning, noon, afternoon, evening and midnight [39,40].

The present investigation was designed to study the impact of listening to rāga *Desi-Todi* on the psychophysiological health and well-being of healthy males and females, employing two measures for physical health (blood pressure and heart rate), three measures for mental health (stress, anxiety and depression), and four measures for well-being (life satisfaction, optimism, hope and meaning in life). It was assumed that listening to rāga *Desi-Todi*, a slow-paced soothing and relaxing music [39,40], would decrease blood pressure and heart rate [15,41-43], reduce stress, anxiety and depression [15,41-43], and enhance life satisfaction, optimism, hope and meaning in life [15] in both males and females. In line with the findings reported in the literature it was expected that the music would produce more intensified effects in females on indices related to the physical health (blood pressure and heart rate) [33-35] as well as the mental health (stress, anxiety and depression) [33] compared to males; no hypothesis was formulated for such effects on well-being measures (life satisfaction, optimism, hope and meaning in life), the objective was simply exploratory. For the present study only those mental health and well-being measures for which widely used standardized psychometric tests were available were selected. The major focus of this investigation was to study gender differences in changes induced by music listening in listeners' general propensity to music; changes were indexed by various psychophysiological measures.

Methods

Participants

Institutional human research ethics committee approval was obtained prior to recruiting participants for the study. Recruitment was carried out via advertisement placed in a local newspaper. The interested participants were requested to call a study number for more information. This reduced any coercion to participate. The project coordinator (first author) conducted a phone screen to assess inclusion criteria. The inclusion criteria were: (i) age 25 years or older, (ii) well conversant with English and Hindi languages, (iii) have only general interest in music, (iv) have no experience of

performing on musical instruments, (v) have approximately 14 years of education.

Sixty males and sixty females were recruited. Five males and six females opted to drop out after learning their assignment that they would be required to attend the laboratory for 22 days (20 day's intervention, 1 day for pre-testing, and 1 day for post-testing – details are given in the 'procedure' section). Finally, 40 males and 40 females were randomly selected as participants, and the remaining 15 males and 14 females were retained for replacements. The participants were assigned to two subgroups randomly, using random numbers table, in equal numbers: males: music subgroup (n = 20) and control subgroup (n = 20); females: music subgroup (n = 20) and control subgroup (n = 20). No participant dropped out of the study after the randomization procedure. Participants' average ages were: males (n = 40): mean = 36.7 years, SD = 4.9; females (n = 40): mean = 35.9 years, SD = 4.7.

Design

Pre- and post-treatment procedure was adopted for assessments on variables under study. The study followed a gender (males and females) × treatments (music subgroup and control subgroup) × testing sessions (pre-test and post-test) factorial design with repeated measures on the last factor. Therefore, one replication of the design (gender × treatments) needed 4 participants. The design was replicated 20 times and involved 80 participants.

Procedure

The study and its implications were explained to the participants prior to their participation. It was made distinctively clear that there was no compulsion to participate in the study and they had a right to withdraw at any time. They were also told that they would not be getting any payment for acting as participants. (In India, participants are generally not paid.) An appeal for cooperation was made stating that by acting as participants they would be contributing to a study that might advance knowledge. In addition, they were assured free counseling services for next three years in case they faced any psychobehavioral problem, and were told that a certificate that contains appreciation for participation as well as a written assurance for free counseling services for next three years would be given to the participants after the post-treatment testing is completed. Hence, only those persons who volunteered themselves and provided their written consent to participate were accepted as participants for the study. They were also requested to abstain from all kinds of music during the course of the study (22 days). This was done to ensure that the participants' response measures were only under the influence of the presented music.

Pre- and post-treatment procedure was adopted for assessments on variables under study. Each participant was tested individually for all pre- and post-treatment assessments. The pre-treatment assessments were done a day before the commencement of the music treatment while the post-treatment testing was done a day after the music treatment was over.

The participants in the music subgroups (males and females) listened to instrumental music (without lyrics and tabla), with eyes closed to minimize distractions, through head phones for 30 minutes from 9 a.m. to 9.30 a.m. daily for 20 days.

The participants in the control subgroups (males and females) were simply tested for assessments related to physical health, mental health and well-being, and retesting was done after 20 days. They were required to visit the laboratory daily and sit in silence in a separate room between 9 a.m. and 9.30 a.m. for 20 days. This was done to make the testing situation comparable to that of the participants in the music subgroups. Recently-published magazines that contained short stories, articles, poems etc. were placed on a table in the room. The participants could pick up the magazine and read it silently.

Two trained assistants tested the participants on various psychophysiological measures for all pre- and post-treatment assessments. The assistants were, however, inter-changed for the post-treatment assessments, that is, one assistant carried out the pre-treatment assessments while the post-treatment assessments were done by the other assistant. The assistant who did pre-treatment assessments also presented the music treatment to the participants.

The certificate that contained appreciation for participation as well as written assurance for free counseling services for next three years was handed over to each participant after the post-treatment assessments were completed.

Measures

Physical health

Blood pressure and heart rate. Blood pressure (BP) and heart rate (HR) were recorded using an HEM-732C-C1 (M×2) automatic digital blood pressure monitor (Omron Corporation, Tokyo). The Omron monitor detects blood pressure to an accuracy of ± 2% and the pulse to an accuracy of ± 5% of the reading. Systolic and diastolic blood pressure, detected oscillometrically [44,45], were displayed digitally on the monitor's front panel to an accuracy of ± 3 mmHg. Cuff (480 × 180 mm) deflation was approximately 5 mmHg/s. BP recordings took place on the left arm. HR was recorded automatically by counting the number of BP oscillations during each cycle of BP measurement. The BP and HR recordings were done three times with an interval of 3 minutes in between. With a view to deriving stable measures,

averages of the three recordings for BP as well as for HR were calculated, and these averaged figures served as units of analysis for the present study.

Mental health

Stress. To measure stress, the Perceived Stress Scale (PSS) [46] was used. The test measures the degree to which situations in one's life are perceived as stressful. This test consists of 14 items. Respondents are required to indicate for each item on a 5-point Likert scale ranging from 0 (never) to 4 (very often) as to how they have felt or thought in line with the statement during the previous month. The scores on the test range from 0 to 56; higher scores indicate greater amount of perceived stress. This test has been used in several studies conducted in Indian setting [47]. Cronbach's alpha for this study (males and females combined) was .89.

Anxiety. The Hindi version [48] of the widely used trait scale of the State-Trait Anxiety Inventory (STAI) [49] was used to determine scores on trait anxiety. The trait scale of the STAI consists of 20 statements. Respondents are required to indicate for each statement on a 4-point Likert scale ranging from 1 (almost never) to 4 (almost always) as to how they generally feel. The scores on the test range from 20 to 80; higher scores indicate higher levels of anxiety. The Hindi version of the trait scale of the STAI has been used extensively in India [47]. Cronbach's alpha for this study (males and females combined) was .91.

Depression. The Beck Depression Inventory (BDI) [50] was used to determine depression scores. The BDI is a 21-item scale measuring attitudes and symptoms associated with various aspects of depression, particularly the cognitive, behavioral, affective and somatic aspects. Each item provides four options (statements). Respondents are required to tick one of the four alternatives, providing a score of 0 to 3 for each item. The scores on the test range from 0 to 63; higher scores indicate greater severity of depressive symptomatology. This test has been used in several studies carried out in Indian setting [47]. Cronbach's alpha for the current sample (males and females combined) was .87.

Well-being

Life satisfaction. To measure global life satisfaction, Satisfaction with Life Scale (SWLS) [51] was used. The test contains five items. Respondents are required to rate each item on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The scores on the test range from 5 to 35; higher scores indicate higher levels of life satisfaction. Cronbach's alpha for the current sample (males and females combined) was .88.

Optimism. To measure dispositional optimism which is characterized by favorable personal future expectations, the revised version of a self-report Life Orientation Test (LOT-R) [52] that contained 6 items was used in the present study. Respondents rate each item on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The scores on the test range from 6 to 30; higher scores represent higher levels of optimism. Cronbach's alpha in the present study (males and females combined) was .86.

Hope. Hope was measured by the Hope Scale [53] which consists of 12 items. The test contains three types of items: 4 items reflect pathways, 4 items agency, and 4 items are distractors. Respondents are required to rate the extent to which each statement applies to him or her on an 8-point Likert continuum ranging from 1 (definitely false) to 8 (definitely true). Hope score is the sum of 4 pathways and 4 agency items. The scores on the test range from 8 to 64; higher scores represent higher levels of hope. Cronbach's alpha for the current study (males and females combined) was .89.

Meaning in life. To assess the degree to which participants feel that their lives are meaningful, the presence subscale of the Meaning in Life Questionnaire (MLQ) [54] was used. The MLQ is a 10-item self-report measure and is composed of two subscales: presence of meaning and search for meaning, each consisting of five items. Respondents rate each item on a 7-point Likert scale ranging from 1 (absolutely untrue) to 7 (absolutely true). The scores on each subscale range from 5 to 35; higher scores represent more meaningfulness in life. Cronbach's alpha for the presence subscale in the current study (males and females combined) was .87.

As mentioned earlier, the Hindi version of the STAI was used for measuring trait anxiety while the original English versions were used for tests related to other measures. Participants (males and females) were well conversant with both the languages.

Analysis

Post-treatment scores are under the direct influence of the baseline (pre-treatment) scores if both the scores (pre-treatment and post-treatment) are derived from the same participants. Researches have used various measures to neutralize the baseline impact: (i) difference measure (post-minus pre-treatment score) [55,56], (ii) inflexion ratio (difference score divided by the pre-treatment score) [57,58], (iii) regression [59] or residual change [56] score, that is, the difference between the post-treatment score and the predicted score, derived with the help of regression equation based upon the functional relationship between pre- and post-treatment scores. In a study [60] on university students (N = 200), it was demonstrated that the three measures, mentioned above, were highly correlated, correlations ranged between .94 to .99. Even

the use of ANCOVA is implicit in the "regression" or "residual change" score which, as mentioned above, has a high significant correlation with the difference score. The limitation of inflexion ratio is that it does not lead to normal distribution [61]. Hence, a difference score (post-treatment minus baseline) was worked out for each participant in respect of all the physiological and psychological assessments. The difference scores reflect changes induced by music listening in listeners' general propensity to music. Difference scores, as mentioned above, have been used in many studies [15,62-66]. The obtained difference scores, for each dependent variable, were analyzed by two-way (gender by treatments) ANOVA. The effect size was evaluated by omega squared (ω^2).

Results

The difference scores of all the male and female participants for the music subgroups (T_1) were negative for systolic and diastolic BP, HR, stress, anxiety and depression, and positive for life satisfaction, optimism, hope and meaning in life. The music treatment led to a decrease in the physiological indices and the negative affect, and an increase in the positive affect.

For the male control subgroup (T_2) one difference score each for HR, systolic BP, anxiety, stress and life satisfaction, and for the female control subgroup (T_2) one difference score each for diastolic BP, depression, meaning in life, optimism and hope were not in the expected direction, i.e., slightly higher post-test scores were observed for the indices of physical health (difference score was less than +1.0 for each variable) and mental health (difference score was +1.0 for anxiety as well as for depression, difference score was +2.0 for stress) and slightly lower for the indices of well-being (difference score was −1.0 for each variable). Different participants provided the above mentioned difference scores (e.g., one difference score for one variable was provided by one participant, another difference score for another variable was provided by another participant). It seems pertinent to mention that male and female participants in the control subgroups (T_2) were simply tested and retested on various psychophysiological variables. No intervention or experimental treatment was provided to participants in such subgroups (T_2), hence only the momentary fluctuations operated at the time of retesting (post-testing). As the direction of the observed difference scores for the control subgroups (T_2) was not particularly interesting, the absolute (unsigned) difference score was worked out for each participant (male and female) in the control subgroups (T_2).

The means and standard deviations worked out from the absolute (unsigned) difference scores for the variables associated with physical health, mental health and well-being are reported in Table 1. The gender by treatments ANOVA results along with the effect size evaluated by omega squared (ω^2), are given in Tables 2-4.

(click to view Table 1)

Physical health

(click to view Table 2)

The results reported in Table 2 demonstrated that females had significantly higher difference scores following music treatment (indicating significantly greater decrease in the index following music treatment) for systolic BP ($F = 6.154$, $p < .02$, $\omega^2 = .046$), diastolic BP ($F = 8.438$, $p < .005$, $\omega^2 = .062$) and heart rate ($F = 9.931$, $p < .005$, $\omega^2 = .08$) than males; no significant difference was found between the male and female control subgroups for any of the physical health parameters.

The results also showed that the females in the music subgroup had significantly higher difference scores following music treatment (indicating significantly greater decrease in the index) for systolic BP ($F = 32.554$, $p < .001$, $\omega^2 = .279$), diastolic BP ($F = 37.839$, $p < .001$, $\omega^2 = .307$) and heart rate ($F = 30.414$, $p < .001$, $\omega^2 = .264$) than those in the control subgroup; such differences for males were nonsignificant for all the physical health parameters.

Mental health

(click to view Table 3)

The results (Table 3) demonstrated that females, compared to males, had significantly higher difference scores following music treatment (indicating significantly greater decrease in the index) for stress ($F = 11.1$, $p < .005$, $\omega^2 = .047$), anxiety ($F = 26.465$, $p < .001$, $\omega^2 = .051$) and depression ($F = 19.161$, $p < .001$, $\omega^2 = .063$); no significant difference was found between the male and female control subgroups for any of the mental health parameters.

The results also reflect that both males and females had significantly higher scores following music treatment (indicating significantly greater decrease in the index) for stress (males: $F = 35.22$, $p < .001$, $\omega^2 = .158$; females: $F = 101.995$, $p < .001$, $\omega^2 = .465$), anxiety (males: $F = 115.835$, $p < .001$, $\omega^2 = .232$; females: $F = 295.696$, $p < .001$, $\omega^2 = .594$) and depression (males: $F = 46.518$, $p < .001$, $\omega^2 = .157$; females: $F = 161.917$, $p < .001$, $\omega^2 = .556$) than the respective control subgroups.

Well-being

(click to view Table 4)

The results presented in Table 4 demonstrated that females, compared to males, had significantly higher scores following music treatment (indicating greater increase in the index) for life satisfaction ($F = 14.087$, $p < .001$, $\omega^2 = .051$), optimism ($F = 21.159$, $p < .001$, $\omega^2 = .091$) and meaning in life ($F = 10.96$, p

< .005, ω^2 = .054); no significant difference was observed between the male and female control subgroups for any of the indices related to well-being.

The results also show that both males and females had significantly higher scores following music treatment (indicating significantly greater increase in the index) for life satisfaction (males: F = 53.261, p < .001, ω^2 = .205; females: F = 113.087, p < .001, ω^2 = .44), optimism (males: F = 39.2, p < .001, ω^2 =.172; females: F= 87.004, p <.001, ω^2 =.387), hope (males: F = 38.2, p <.001, ω^2 = .214; females: F = 58.737, p < .001, ω^2 = .331) and meaning in life (males: F = 30.125, p < .001, ω^2 = .159; females: F = 68.501, p < .001, ω^2 = .369) than the respective control subgroups.

Discussion

The results demonstrate that listening to slow-paced instrumental music (without lyrics and tabla) that consisted of repetitive notes or beats for 30 minutes a day for 20 days stabilizes cardiovascular reactivity in females, as was indicated by a significant decrease in BP and HR, significantly reduced stress, anxiety and depression in both males and females, and promoted wellness as is indicated by significant increases in scores on life satisfaction, optimism, hope and meaning in life in both males and females. The results indicate that music exerts possible beneficial effects on psychophysiological health, not only by reducing the negative influence and diminishing the biological consequences of stress, but also by promoting wellness as is indicated by enhanced indicators of well-being in healthy individuals. Because of the potential capacity of music listening to affect a multitude of different physiological and psychological parameters, music may have a beneficial impact on our health and well-being. It has been reported that individuals with high positive emotion experience less heart disease, and are approximately 18% less likely to die of any cause than people with average or low positive emotion [67]. Favorable effects of positive affect states on several health-related biological markers, such as neuroendocrine, cardiovascular and inflammatory processes have also been reported [68]. Positive emotions perhaps build personal resources that can promote and protect good health.

Slow-paced music may produce a soothing effect because the elevated body rhythm might entrain with a slower and more natural homeostatic rhythm produced by the musical composition. Entrainment is perhaps facilitated if the music's marked pulse is close to an individual's natural heart rate and respiration [69]. It has also been reported that changes in the heart rate are directly related to the tempo [70]. When soothing lullabies are played for infants, their breathing rhythms become synchronized with the musical rhythm [71]. A relatively recent study [72] has demonstrated synchronization and entrainment of brain waves to periodic auditory stimuli (drum sounds and clicks) presented with stimulation rates of 1-8 Hz, a range most relevant to human repetitive sensorimotor behavior [72]. Periodic auditory stimulation produced a mixture of evoked and induced brain wave synchronization that could influence various cognitive functions involved in learning and memory tasks[72]. Moreover, "rhythmic entrainment" features at the second spot in the seven mechanisms (proposed by Juslin and associates [4]) through which music might induce emotions [4].

The present findings of nonsignificant effects of music on BP and HR in healthy male participants are in accord with earlier findings [15,62]. Women use music to influence and regulate emotions to a larger extent than men [36]; may be women are more sensitive to music than men. This assumption gets support from the present findings which demonstrate that the effects of music listening are more intense in females than males on all parameters related to physical health, mental health and well-being, except the 'hope' scores. Females' greater sesitivity to music might be the reason for music's significant effect on BP and HR in females. The findings of music's heightened effects on BP, HR, stress, anxiety and depression in females, compared to males, are consistent with the findings reported in the literature [33]. Music's heightened effect for females on measures related to well-being, except the 'hope' scale, has been observed in the present study. There are no apparent reasons for the nonsignificant gender differences in the 'hope' scores. It may, however, be pointed out that 'hope' is a wide construct and involves commitment (to one's self, work and other values), control (over one's life), and challenge (i.e., a belief that change is stimulating) [53]. Hope lessens the distance between the person and the potential for success whereas optimism creates a distance between the person and the potential for failure [53]; the former's task seems more arduous.

The findings related to the positive affect, as mentioned above, are of practical importance because individuals spend a significant amount of time and energy structuring their lives in ways that facilitate positive feelings and emotions [16]. Emotional regulation is often the major reason for listening to music [17-20]. Music also facilitates social interactions and interpersonal relationships [29].

Music may have a beneficial effect on individuals' health and well-being through its potential capacity to affect a multitude of different neurochemical, physiological and psychological parameters. More concerted inter-disciplinary efforts are essentially needed to study the in-depth impact of listening to music on these diversified parameters. Further studies, using longitudinal designs, are also needed to ascertain the sustainability of the music-induced behavioral changes over longer periods of time.

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Table 1. *Difference Score Means and Standard Deviations for Behavioral Measures: Gender by Treatments (n = 20).*

Measures	Males				Females			
	Music Treat (T_1)		Control (T_2)		Music Treat (T_1)		Control (T_2)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Physical health								
Systolic BP (mmHg)	2.24	.72	1.82	.68	2.84	.89	1.46	.67
Diastolic BP (mmHg)	2.28	.76	1.82	.66	2.96	.85	1.52	.59
Heart rate (bpm)	2.16	.75	1.86	.69	2.88	.74	1.62	.63
Mental health								
Stress	2.48	.61	1.34	.46	3.12	.76	1.18	.49
Anxiety	5.32	1.07	2.14	.61	6.84	1.21	1.76	.58
Depression	2.76	.68	1.42	.49	3.62	.73	1.12	.48
Well-being								
Life satisfaction	2.56	.72	1.16	.42	3.28	.68	1.24	.49
Optimism	2.23	.45	1.25	.41	2.95	.54	1.49	.52
Hope	3.28	.83	1.78	.67	3.56	.79	1.70	.69
Meaning in life	2.86	.85	1.60	.46	3.62	.91	1.72	.49

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Table 2. Results of Analysis of Variance for Measures of Physical Health: Gender by Treatments (n = 20).

Measure	Source	SS	*df*	MS	*F*	*P*	ω^2
Systolic BP (mmHg)	Gender (G)	0.288	1	0.288	0.492	n.s.	-.005
	for T_1	3.600	1	3.600	6.154	<.02	.046
	for T_2	1.296	1	1.296	2.215	n.s.	.011
	Treatments (T)	16.200	1	16.200	27.692	<.001	.236
	for males	1.764	1	1.764	3.015	n.s.	.018
	for females	19.044	1	19.044	32.554	<.001	.279
	G × T	4.608	1	4.608	7.877	<.01	.061
	Within	44.436	76	0.585			
Diastolic BP (mmHg)	Gender (G)	0.722	1	0.722	1.318	n.s.	.003
	for T_1	4.624	1	4.624	8.438	<.005	.062
	for T_2	0.900	1	0.900	1.642	n.s.	.005
	Treatments (T)	18.050	1	18.050	32.938	<.001	.266
	for males	2.116	1	2.116	3.861	n.s.	.024
	for females	20.736	1	20.736	37.839	<.001	.307
	G × T	4.802	1	4.802	8.763	<.005	.065
	Within	41.676	76	0.548			
Heart rate (bpm)	Gender (G)	1.152	1	1.152	2.207	n.s.	.011
	for T_1	5.184	1	5.184	9.931	<.005	.080
	for T_2	0.576	1	0.576	1.103	n.s.	.001
	Treatments (T)	12.168	1	12.168	23.310	<.001	.200
	for males	0.900	1	0.900	1.724	n.s.	.007
	for females	15.876	1	15.876	30.414	<.001	.264
	G × T	4.608	1	4.608	8.828	<.01	.070
	Within	39.662	76	0.522			

Note. Effect size was evaluated by omega squared (ω^2)

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Table 3. Results of Analysis of Variance for Measures of Mental Health: Gender by Treatments (n = 20).

Measure	Source	SS	*df*	MS	*F*	*P*	ω^2
Stress	Gender (G)	1.152	1	1.152	3.122	n.s.	.010
	for T_1	4.096	1	4.096	11.100	<.005	.047
	for T_2	0.256	1	0.256	0.694	n.s.	-.001
	Treatments (T)	47.432	1	47.432	128.542	<.001	.587
	for males	12.996	1	12.996	35.220	<.001	.158
	for females	37.636	1	37.636	101.995	<.001	.465
	G × T	3.200	1	3.200	8.672	<.005	.035
	Within	28.028	76	0.369			
Anxiety	Gender (G)	6.498	1	6.498	7.443	<.01	.013
	for T_1	23.104	1	23.104	26.465	<.001	.051
	for T_2	1.444	1	1.444	1.651	n.s.	.001
	Treatments (T)	341.138	1	341.138	390.765	<.001	.786
	for males	101.124	1	101.124	115.835	<.001	.232
	for females	258.064	1	258.064	295.606	<.001	.594
	G × T	18.050	1	18.050	20.676	<.001	.040
	Within	66.350	76	0.873			
Depression	Gender (G)	1.568	1	1.568	4.062	<.05	.011
	for T_1	7.396	1	7.396	19.161	<.001	.063
	for T_2	0.900	1	0.900	2.332	n.s.	.005
	Treatments (T)	73.728	1	73.728	191.005	<.001	.656
	for males	17.956	1	17.956	46.518	<.001	.157
	for females	62.500	1	62.500	161.917	<.001	.556
	G × T	6.728	1	6.728	17.430	<.001	.057
	Within	29.316	76	0.386			

Note. Effect size was evaluated by omega squared (ω^2)

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Table 4. Results of Analysis of Variance for Measures of Well-being: Gender by Treatments ($n = 20$).

Measure	Source	SS	*df*	MS	*F*	*P*	ω^2
Life satisfaction	Gender (G)	3.200	1	3.200	8.696	<.005	.030
	for T_1	5.184	1	5.184	14.087	<.001	.051
	for T_2	0.064	1	0.064	0.174	n.s.	-.003
	Treatments (T)	59.168	1	59.168	160.783	<.001	.627
	for males	19.600	1	19.600	53.261	<.001	.205
	for females	41.616	1	41.616	113.087	<.001	.440
	G × T	2.048	1	2.048	8.283	<.01	.018
	Within	27.946	76	0.368			
Optimism	Gender (G)	4.608	1	4.608	18.808	<.001	.080
	for T_1	5.184	1	5.184	21.159	<.001	.091
	for T_2	0.576	1	0.576	2.351	n.s.	.006
	Treatments (T)	29.768	1	29.768	121.502	<.001	.543
	for males	9.604	1	9.604	39.200	<.001	.172
	for females	21.316	1	21.316	87.004	<.001	.387
	G × T	1.152	1	1.152	4.702	<.05	.017
	Within	18.652	76	0.245			
Hope	Gender (G)	0.200	1	0.200	0.340	n.s.	-.004
	for T_1	0.784	1	0.784	1.331	n.s.	.002
	for T_2	0.064	1	0.064	0.109	n.s.	-.005
	Treatments (T)	56.448	1	56.448	95.837	<.001	.544
	for males	22.500	1	22.500	38.200	<.001	.214
	for females	34.596	1	34.596	58.737	<.001	.331
	G × T	0.648	1	0.648	1.100	n.s.	.001
	Within	44.760	76	0.589			
Meaning in life	Gender (G)	3.872	1	3.872	7.347	<.01	.035
	for T_1	5.776	1	5.776	10.960	<.005	.054
	for T_2	0.144	1	0.144	0.273	n.s.	-.004
	Treatments (T)	49.928	1	49.928	94.740	<.001	.512
	for males	15.876	1	15.876	30.125	<.001	.159
	for females	36.100	1	36.100	68.501	<.001	.369
	G × T	2.048	1	2.048	3.886	n.s.	.016
	Within	40.046	76	0.527			

Note. Effect size was evaluated by omega squared (ω^2)

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