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Differences in the effects of preferred music and relaxation music on anxiety in older people

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Abstract

Music is known to have an ability to reduce anxiety. Here we compared the effects of two types of music, preferred music and relaxation music, on anxiety in older people. One hundred and fifteen healthy volunteers aged between 58 and 87 years (80 women and 35 men; mean ± SD = 70.0 ±6.1 years) were matched by sex and region and randomly assigned to one of the following three groups: a control group, a preferred music group, and a relaxation music group. The State-Trait Anxiety Inventory (STAI), heart rate, and autonomic nerve function were measured. A significant decrease was found in the STAI scores of the preferred music group compared to those of the control group ($p < 0.05$), while no significant difference was found between the relaxation music group and the control group. These results suggest that preferred music may be more effective than no music at reducing the subjective anxiety of older people and that the anxiolytic effect of relaxation music may be about the same as that of no music.

Keywords:

patient preference, anxiety, heart rate, aged

Introduction

Anxiety is one of the major feelings experienced by everyone in daily life. It is generally known that older people feel extremely lonely due to chronic diseases, decreased functional abilities, and feelings of loss (e.g., of roles in society and family and loved ones who have passed away). The state of anxiety caused by such occurrences may induce various psychiatric diseases including neurotic disorders and major depressive disorders, adversely affecting their quality of life in the community. Although it is important to get rid of or cope with these causes of anxiety, it is also important to reduce their actual anxiety through symptomatic therapy. Music is one of many therapies that reduce anxiety[1)].

The effects of preferred music and relaxation music have been investigated in patients suffering from various diseases using psychological and physiological variables. The reported psychological effects of preferred music include decreases in (1) anxiety in patients before vascular angiograph procedures and in day surgery[2,3)], (2) depression and confusion in patients after middle cerebral artery stroke[4)], (3) pain in patients following nasal and intestinal surgery[5,6)], (4) decreased pain, depression, and disability in patients with chronic non-malignant pain[7)], and (5) pain and decreased acute confusion in patients undergoing hip and knee surgery[8)]. The reported physiological effects of preferred music include decreases (1) heart rate in patients before vascular angiograph procedures[2)], and (2) heart rate and systolic blood pressures in patients following nasal surgery[5)]. The reported psychological effects of relaxation music include decreases (1) anxiety in patients during intracardiac catheterization[9)], (2) anxiety and pain in patients during colonoscopy and after open-heart surgery[10,11)], (3) pain in patients undergoing a C-clamp procedure and upon dressing change[12,13)], and (4) acute

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confusion and delirium in patients undergoing elective hip and knee surgery[14]. The reported physiological effects of relaxation music include decreases (1) heart rate, respiratory rate, and oxygen saturation in patients undergoing a C-clamp procedure[12], (2) salivary amylase activity in patients under epidural anesthesia[15], (3) salivary cortisol level in patients during colonoscopic examination[16], and (4) cortisol level and ratio of cortisol and dehydroepiandrosterone sulphate[17].

However, few previous studies have focused on anxiety. While many subjects in the studies were older people, the majority of them had specific diseases. Accordingly, even if the results showed that music had good effects, its effectiveness might have been demonstrated only for specific diseases or conditions that were likely to induce anxiety, and the results cannot be generalized to average older people.

Accordingly, we examined and compared the effects of preferred and relaxation music on anxiety in older people in general by using psychological and physiological variables.

Methods

Design

The study employed controlled clinical trials (CCTs) using three groups: a control group, a preferred music group, and a relaxation music group. This design was approved by the ethics committees of the University of Mejiro, Saitama Prefecture, Japan.

Participants

Participants included 115 Japanese volunteers aged between 58 and 87 years living in a community [mean age: 70.0 (SD 6.1), women: men = 7:3]. People living in cities and local regions were selected after confirming that their homes were located within a reasonable traveling distance from the site of investigation. All the participants signed informed consent documents. After the participants had been classified by gender and region, they were randomly assigned to one of the three groups. The physical condition of the participants was examined by interview on the day of the experiment to ensure that they had no health problems.

Psychological variables

The State-Trait Anxiety Inventory Form JYZ (STAI) was used to measure state anxiety. Forty subjective variables composed of 20 items on state anxiety and 20 items on trait anxiety, and the subjects are asked to pick one of four choices for each item[18]. In this study, only the items on state anxiety were tested. The scores attributable to the choice made for each item were summed up to obtain overall scores ranging from 20 to 80. Scores below 45 indicated low levels of anxiety and scores above or equal to 55 indicated high anxiety levels[19].

Physiological variables

The heart rate, ratio of the power value of low and high frequency areas (LF/HF ratio), and ratio of the power value of high frequency areas and total power areas (HF/TP ratio) [20] were measured using an acceleration plethysmography (ARTETT, U-MEDICA, Inc. Co., Osaka, Japan). We measured these variables under natural breathing conditions for 2 minutes. The machine automatically calculated variation coefficients for a-a intervals obtained from acceleration plethysmograms in order to evaluate autonomic nerves functions. While the machine performed calculations in the same way as the conventional method of calculating variation coefficients for ECG R-R intervals[21], its highly efficient reflective sensor could be conveniently connected to a personal computer with a USB. Moreover, it was a portable machine that accurately obtained acceleration plethysmograms from a fingertip. Both the maximum entropy method (MEM) and the Fast Fourier transform (FFT) method may be employed for analyzing the frequency spectrum, although MEM was used in this study.

Stressor task

A simple 10-minute task was used as stressor. The participants used chopsticks to move beans from one box to another box.

Musical selection and presentation

Two different music types —preferred music and relaxation music— were used for intervention.

The participants in the preferred music group chose their own preferred music. If they could not recall their favorite music pieces, a list was provided that included nursery rhymes, songs for schoolchildren, and pop songs (590 in total) that were popular from the Meiji Period (1868-1912) through to the Showa Period (1926–1988), as the participants were likely to be familiar with these songs.

For relaxation music, three occupational therapists experienced in music therapy listened to several CDs of relaxation music marketed in Japan. They selected *Windmill in Summer* by Wong Wing Tsan (Nature-relaxation Japan -2000, Universal Music K.K., Japan) because it seemed most acceptable for Japanese people.

We offered the participants four minutes listening. The participants listened to the music with headphones (ATH-AD700, Audio-Technica, Japan) from a CD player (Clavia RC-A1, Victor, Japan).

Procedure

The experiment was carried out from 10:00AM to 3:00 PM in a welfare center, public hall, and residents' association hall in the community. The room temperature and humidity were set at levels that were comfortable for the participants: room temperature between 18º C and 28º C and humidity between 40% and 75%.

Measurements of the relevant variables were taken individually in accordance with the procedure in Fig. 1. The participants were engaged in the stressor task in a sitting position. After the 10-minute task, psychological and physiological variables were determined (before listening to music). Next, for four minutes, participants in the preferred music group listened to their preferred music and those in the relaxation music group listened to the selected relaxation music. Participants in the control group closed their eyes for four minutes without doing anything. After listening to music (or, for those in the control group, resting), psychological and physiological variables were measured again.

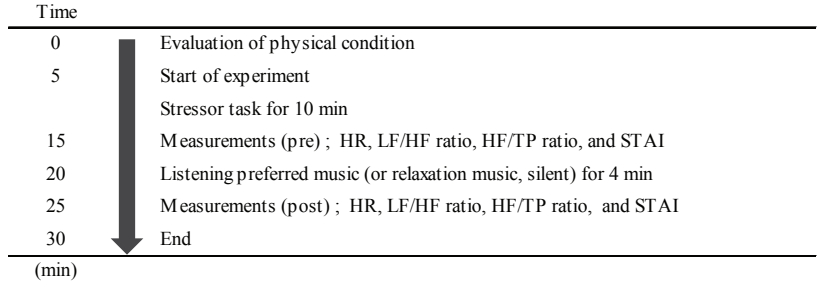

Figure 1. Time-schedule of the experiment.

HR = Heart rate, LF/HF ratio = Ratio of the power value of low and high frequency areas by frequency analysis, HF/TP ratio = Ratio of the power value of high frequency and total power areas by frequency analysis,
STAI = The state-trait anxiety inventory.

Statistical analysis

Intergroup comparison was made on the participants' attributes by using a non-parametric test (Pearson's chi-squared test).

A two-way ANOVA (unpaired x paired) was performed. The total STAI scores, heart rate, LF/HF ratio, and HF/TP ratio were examined in association with the main effect (group or time [pre- to post-listening]) and the interaction effect of group x time. When a significant difference was observed both in main effect and interaction effect, a single main effect test was added, and then, multiple comparisons were conducted using Bonferroni's method.

If a group showed favourable effects in the two-way ANOVA, it was further investigated by Pearson's correlation test or Spearman's rank correlation test to clarify the relation between the psychological and physiological variables.

The level of statistical significance was set at $p < 0.05$. All statistical analyses were performed using SPSS version 17.0.

Results

Participants

There were no statistically significant differences between the three groups in the baseline demographic or clinical variables or the music-related information (Table 1).

Table 1. Baseline characteristics of the three groups (n=115)

		Preferred music group	Relaxation music group	Control group	χ^2
Background characteristics					
Sex	men	**12**	**12**	**10**	**0.09**
	women	**27**	**28**	**26**	**ns**
Age	<65 years old	**7**	**5**	**8**	
	65-75 years old	**27**	**24**	**20**	**3.72**
	75> years old	**5**	**11**	**8**	**ns**
Region	city	**23**	**23**	**22**	**0.10**
	country	**16**	**17**	**14**	**ns**
Medical data; Cardiovascular medication					
	yes	**15**	**15**	**15**	**0.15**
	no	**24**	**25**	**21**	**ns**
Level it likes music; How did you like music?					
	A lot	**14**	**13**	**14**	
	some	**18**	**16**	**9**	**4.87**
	only a little	**7**	**11**	**13**	**ns**
Level of music experience					
	studied music at university	**0**	**1**	**1**	
	took music lessons	**11**	**14**	**12**	**2.44**
	didn't take music lessons	**28**	**25**	**24**	**ns**
Level of state anxiety					
	high	**0**	**1**	**1**	
	medium	**8**	**9**	**7**	**1.18**
	low	**31**	**30**	**28**	**ns**
State of autonomic nerve function (LF/HF/MEM)					
	4<	**4**	**4**	**3**	
	3-4	**1**	**4**	**1**	
	2-3	**4**	**6**	**3**	**4.27**
	<2	**30**	**26**	**29**	**ns**

Note. Anxiety level was calculated from the result before it listened referring to the STAI manual Japanese version[19].

Autonomic nerve function state was calculated from the result before it listened referring to Takada's criterion[20]. It was judged by the LF/HF-MEM value as follows: less than two were in a calm state, less than 3 from 2 were in the ordinary state, less than 4 from 3 were in the condition with gray zone at which it gets excited, and four or more were in the condition at which it gets excited (see References for details).

ns = no significance

The State-Trait Anxiety Inventory (STAI)

The pre- and post-music total STAI scores were examined (Figure 2). The pre-listening level was 36.9 ± 9.4 in the preferred music group, 36.9 ± 10.2 in the relaxation music group, and 37.9 ± 10.0 in the control group. No significant difference was detected in pre-listening level of total STAI scores between groups, F (2,112) = 0.12, *ns*. The post-listening level was 28.9 ± 8.6 in the preferred music group, 32.9 ± 8.8 in the relaxation music group, and 34.7 ± 9.9 in the control group. The main effects of time and the interaction effect of group x time were observed, F (1,112) = 60.01, p =0.000, F (2,112) = 4.94, p = 0.009, respectively. Analysis by the single main effect of time showed a significant reduction in the post-music scores of all groups, F (1,112) = 50.01, p = 0.000, F (1,112) = 13.31, p = 0.000, F (1,112) = 7.62, p = 0.007, respectively. In the post-music scores, the single main effect of group was demonstrated, F (2,112) = 4.03, p = 0.020. In the post hoc test, the scores of the preferred music group significantly decreased, as compared with those of the control group (p = 0.021) , while there were no significant differences were found between the relaxation music and the control groups (p > 0.05), or between the preferred music and the relaxation music groups (p > 0.05) (Figure 2).

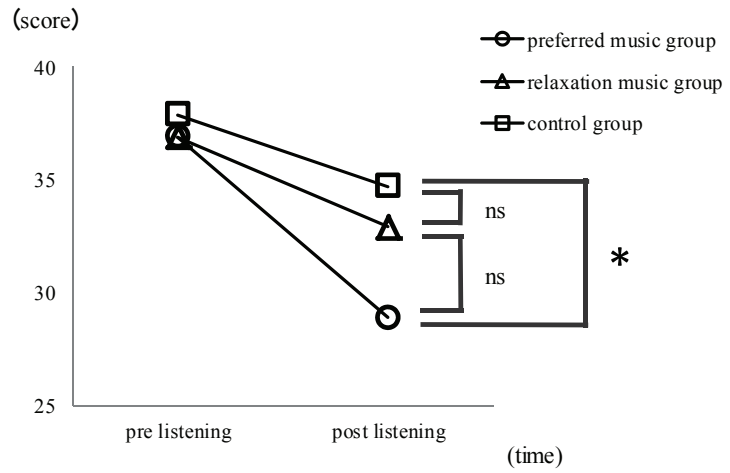

Figure *2*. STAI total score (mean) in the three groups at the pre- and post- listening phases.

At the post listening phase, the STAI score was significantly lower in the preferred music group than in the control group based on Bonferroni's test in multiple comparisons.
$* p < 0.05$. *ns* = no significant

Heart rate

The pre- and post-music heart rates were examined. The mean heart rate before listening to music was 71.4 ± 12.2 in the preferred music group, 73.9 ± 15.0 in the relaxation music group, and 70.4 ± 9.9 in the control group. The mean heart rate after listening to music was 68.5 ± 9.9 in the preferred music group, 71.0 ± 13.4 in the relaxation music group, and 67.1 ± 8.7 in the control group. The main effect of time was observed, and the post-music heart rate decreased in all groups, F (1,112) = 12.03, p = 0.001. Neither the main effect of group nor the interaction of time x group was observed, F (2,112) = 1.16, *ns, F* (2,112) = 0.03, *ns*, respectively.

LF/HF ratio and HF/TP ratio

The pre- and post-music LF/HF ratios and HF/TP ratios were examined. Since the LF/HF ratio data were highly skewed, the data was log-transformed for analysis. The mean LF/HF ratio before listening to music was –0.44 ± 1.35 in the preferred music group, 0.38 ± 1.53 in the relaxation music group, and 0.08 ± 1.24 in the control group. The mean LF/HF ratio after listening to music was 0.06 ± 1.73 in the preferred music group, 0.20 ± 1.69 in the relaxation music group, and 0.08 ± 1.46 in the control group. Neither the main effect of time/group nor the interaction of time x group was observed, F (1,112) = 0.03, *ns, F* (2,112) = 0.53, *ns*, F (2,112) = 0.31, *ns*, respectively. The mean HF/TP ratio before listening to music was 0.41 ± 0.19 in the preferred music group, 0.33 ± 0.20 in the relaxation music group, and 0.35 ± 0.19 in the control group. The mean HF/TP ratio after listening to music was 0.39 ± 0.21 in the preferred music group, 0.34 ± 0.19 in the relaxation music group, and 0.34 ± 0.18 in the control group. Neither the main effect of time/group nor the interaction of time x group was observed, F (1,112) = 0.15, *ns*, F (2,112) = 1.94, *ns*, F (2,112) = 0.11, *ns*, respectively.

Correlation between physiological variables and psychological variables

Correlation coefficients were calculated between physiological variable changes and STAI changes in the preferred music group (Table 2). Significant correlations were found between heart rate and the following STAI items: “total score”, “feel strained”, “feel secure”, “worried”, “feel satisfied”, and “feel content” , r = 0.488, p = 0.002, *rs* = 0.376, p = 0.039, *rs* = 0.332, p = 0.047, *rs* = 0.329, p = 0.047, *rs* = 0.320, p = 0.018, *rs* = 0.319, p = 0.041, respectively. Significant correlations were found between STAI item “feel frightened” and LF/HF and HF/TP ratios, *rs* = 0.373, p =0.020, *rs* = –0.332, p = 0.039, respectively. No significant correlations were noted in other items.

Table 2. Results of correlation coefficient on change of value between STAI scores and physiological measures according to listening to preferred music (n=39)

	Vs Heart rate		Vs LF/HF ratio		Vs HF/TP ratio	
STAI total score (r)	**.488**	**	**.251**		**-.196**	
STAI score of each items (rs)						
I feel strained	**.376**	*	**.286**		**-.079**	
I feel frightened	**.302**		**.373**	*	**-.332**	*
I feel secure	**.332**	*	**.098**		**-.013**	
I am worried	**.329**	*	**.105**		**-.080**	
I feel satisfied	**.320**	*	**-.054**		**.063**	
I feel content	**.319**	*	**.141**		**-.216**	
I feel calm	**.312**		**.082**		**-.006**	
I am tense	**.299**		**.031**		**.010**	
I feel pleasant	**.296**		**.048**		**-.029**	
I am jittery	**.295**		**.153**		**-.045**	
I feel self-confident	**.286**		**-.179**		**.124**	
I feel comfortable	**.170**		**.010**		**-.023**	
I am presently worrying over possible misfortunes	**.191**		**.082**		**-.052**	
I feel indecisive	**.103**		**.222**		**-.144**	
I feel upset	**.154**		**-.107**		**.188**	
I feel steady	**.070**		**.143**		**-.124**	
I feel confused	**.008**		**.133**		**-.025**	
I feel relaxed	**.104**		**.003**		**-.069**	
I feel nervous	**-.027**		**.191**		**-.126**	
I feel at ease	**-.179**		**-.003**		**-.017**	

Note. The correlation coefficient expediently arranged the STAI item in higher order.
* $p < 0.05$, by Spearman's rank correlation test about STAI scores of each item
** $p < 0.01$, by Pearson's correlation test about STAI total score

Discussion

Elderly volunteers living in the community were asked to listen to preferred music or relaxation music. The total STAI score significantly lower in the preferred music group than in the control group. Though the total STAI score in the relaxation music group also decreased, it was not significantly different from the score of the control group. These results indicated that preferred music is likely to reduce the subjective anxiety in older people.

Individual preference has psychological meaning and value[22]. Allowing participants to make their own choice has been shown to motivate behavior. Motivated behavior works as a positive reinforcer, and causes little anxiety[23]. The same might be true of our result that the preferred music reduced the subjective anxiety. In this study, the preferred music was familiar to each subject. Familiarity is also an important factor that can be a source of great relief, especially in the older people[24]. Older people can accept familiar things more easily without anxious feelings[24], while they cannot flexibly accept new things in general, and often feel uncomfortable or anxious[25]. Our results suggest that preferable choice and familiarity are the main factors that reduce subjective anxiety of the elderly.

On the other hand, our results do not fully support the previous finding that relaxation music has an anxiety-reducing effect[9)11)]; i.e., the effect of relaxation music was the almost same as that of the silent condition. The relaxation music in the present study was chosen by experimenter based on their clinical experience. They chose the music with a melody and rhythm that they considered has a relaxation effect and alleviates the anxiety of general elderly people. It has been well noted that people's level of satisfaction is poor when they have a passive role and a low sense of participation in a task[22]. In addition, the selected music was not familiar to the elderly who joined our study. Probably due to the passive participation of subjects and unfamiliarity of the relaxation music, the relaxation music in the present study could not easily produce anxiety-reducing effects. Another possible reason for the different effects of relaxation music might be that

there were differences in the participants between studies. The participants in the previous studies suffered from diseases with anxiety and pain[2)-8)], but our participants were healthy older people living in a community. In other words, the participants in previous studies had substantial psychological/physiological burdens associated with specific diseases, but our participants had no particular burdens outside the experimental sessions.

In this study, we found a significant correlation between the total STAI score change and heart rate change in the preferred music group. We observed a positive relationship in changes between heart rate and the score for anxiety-present items (“feel strained”, “worried”). The heart rate change was significantly and negatively correlated with score change for anxiety-absent items (“secure”, “feel satisfied”, “feel content”). In some older people, the measurement of psychological variables is often difficult due to lowered cognitive function caused by dementia, etc. In such cases, the measurement of heart rate might be able to replace psychological measurement of anxiety in determining the effect of music, if psychological and physiological variables are correlated.

Allowing participants to choose and do what they like leads to satisfaction and increases subjective health[22)]. The result of the present study showed that subjective anxiety decreased in the preferred music group, suggesting the need to tailor care to each elderly people.

There are many factors affecting the mood condition and autonomic nerve function, e.g. illnesses such as mental disorders, neurological diseases and severe diabetes, and environments such as room temperature[26)]. The number of subjects in this study was small and the study was conducted in a community setting which could not establish the experimental condition being fully consistent to each subject. Increasing the number of subjects and using the medical experimental setting should be necessary to confirm the effects of listening to preferred music, relaxation music and no music on anxiety and autonomic nerve function in older people.

Conclusion

Listening to preferred music improved anxiety-related psychological variables of elderly participants more than no music, while the anxiolytic effect of relaxation music may be about the same as that of no music. The results should help to develop a concrete music therapeutic procedure that reduces the anxiety of older people in the community and that contributes to improvement in their quality of life. Further, our results may help to develop music therapy for older people having physical problems and other serious stress factors.

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