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CLINICAL REVIEW

Mindful Music: The Effects of Live Music on Stress at UCLA

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Background

The therapeutic effects of music in alleviating depression, anxiety, and stress have been well-established.¹⁻³ More broadly, music is often an integral component of healthy individuals' lives, as an element of their culture and for recreational enjoyment. Additionally, music therapy has been shown to reduce self-reported stress levels, as well as arousal due to stress, as measured by physical parameters including heart rate, blood pressure, muscle tension, respiratory rate, and perceived pain levels.⁴⁻⁶ While the physiological effects of listening to music are not entirely understood, associations with changes in neurochemical pathways including the dopaminergic, opioid, adrenocorticotrophic, serotonergic, and oxytocin pathways have been noted.⁷ Applications of music therapy in medicine have included reducing anxiety in coronary heart disease and mechanically ventilated patients, reducing stress in low-birthweight infants and patients undergoing brain surgeries, promoting relaxation in palliative care, and improving mood in cancer patients.⁸⁻¹³ Factors including the genre of music and live versus pre-recorded music also influence the response to music. Specifically, positive emotional states are more strongly associated with classical music over heavy metal, and live music over pre-recorded music.^{14,15} Given the positive effects of music on mood and stress, the purpose of this study was to evaluate the effect of live music on stress levels among students on the University of California, Los Angeles (UCLA) campus.

Methods

This UCLA IRB-approved study assessed stress levels in a convenience sample of 331 individuals present in 1 of 8 locations on the UCLA campus between 12:00 pm and 1:00 pm (see table 1). Data was collected from January to June 2015. All participants provided either written or oral informed consent to participate in the study. The participants were exposed to a 30-minute long live music performance. Performed musical genres included classical, jazz, folk, and world. After the performance, participants were given a 6-question survey (table 2), composed of 2 questions that retrospectively ask for self-reported levels of stress before and after the performance (denoted as "before lunch" and "after lunch"), in addition to a 4-question abridged version of the Perceived Stress Scale (PSS¹⁶). Paired t-tests were used to compare responses of the "after lunch" to "before lunch" ratings; the Wilcoxon Rank-Sum or Kruskal Wallis test (if more than two groups) was used to compare scores among groups on the PSS.

Results

Results for questions 1 and 2 show that students' ratings of stress were significantly lower after compared to before lunchtime with exposure to music, as shown in figure 1. The effect size was large (Cohen's $d = .97$). Table 3 shows the means of the ratings on items 3 through 6, on a scale of 0 to 4, further broken down by demographic characteristics in table 4. Significant differences in stress levels by race and location were found. Linear regression was then used to determine relations of the average stress composite index scores with race and location (table 5). The "Black or African American" and "Other" demographic groups demonstrated significantly higher average scores compared to the white group. Likewise, significantly higher average stress scores were found in two library locations relative to other locations.

Comment

Our aim was to evaluate the use of live music as a method of reducing stress in an academic environment and to characterize levels of stress on the UCLA campus. The significant reduction in stress levels from before to after the live music performance suggests that live music may be a viable method of reducing stress levels in an academic setting, where the pressures of school and work tend to cause higher basal levels of stress. This initial uncontrolled study aimed to determine if any differences in "before" and "after" could be elicited within this brief period, and the positive results suggest that it is worthwhile to follow up with a controlled study to investigate differences between lunchtime effects with and without music. The differences in stress levels by race, particularly in blacks, may be difficult to attribute to any single stress factor. In a study examining race and adolescent health, Dowd et al¹⁷ have found higher odds of a high level of stressful life events in blacks compared to whites, and higher levels of stress associated with lower socioeconomic status. Racial discrimination has also been identified as a potentially significant stressor faced by black Americans.¹⁸ Black students are at higher risk for experiencing stereotype threat, and this may be high in UCLA's academic environment; given that 80% of the participants were students, stereotype threat may predispose them to higher levels of stress.¹⁹ Significant differences in stress by location were also found, but because locations were surveyed over different times from January to July, the results may be confounded by temporal factors including, but not limited to, varying levels of stress due to exams, graduation, and other sources of school- or work-related stress. Additionally, locations were chosen by convenience and popularity to attract audience members, rather

than selecting locations at random. Students spending the lunch hour at the library may be likelier to be stressed than those enjoying lunch at a cafeteria.

Limitations

The main limitation of the study is lack of a control condition in which music was not present. There is confounding of lunchtime with music in this study, and thus it is possible that the decrease in self-reported stress may be observed during this period even in the absence of music. Due to the nature of the survey, the self-reported answers were subjective in nature and could not be verified. A retrospective pretest also carries the risk of subjects responding in a way to demonstrate the desired effect, in this case, a reduction in stress. While the variety of locations was intended to produce a broader sample of subjects from across the UCLA campus, less than 1% of the university population was sampled. Therefore, this study population may not provide an accurate indicator of stress levels on the UCLA campus or how the broader UCLA population would be affected by live music during the lunch hour. Finally, several surveys were not entirely filled out, which may have impacted comparability of responses to the survey. Given these limitations, future directions may include performing and administering surveys using systemic sampling to maintain a degree of random sampling but avoiding the risk of clustered selection of participants in simple random sampling. Confounding factors may be reduced by obtaining a larger collection of data and ensuring surveys are entirely filled out. Furthermore, physiological markers of stress such as blood pressure, salivary alpha-amylase, salivary cortisol, CRP, and IL-6 levels may be more reliable methods of measuring stress than subjective questionnaires.²⁰⁻²² These markers may be measured before and after music performances as measures of changes in stress.

Conclusions

Participants showed reduced levels of perceived stress after compared to before a noon-time hour in which live music was performed. The effect size was large (Cohen's $d = .97$); therefore, it appears worthwhile to proceed to examine further the possibly specific effects of music in a controlled study and further to examine if effects might be moderated by location and other factors. While it is difficult to isolate the causes of higher stress levels in different racial groups on UCLA's campus, the results of this study may serve as a useful baseline for better understanding the levels of stress on campus for use by future programs that seek to lower stress levels on campus. Data supporting live music as a useful intervention provides support for future performances among other mindfulness programs on UCLA's campus. By providing quantitative evidence that interventions such as live music can impact stress levels, and by extension, happiness and productivity in the UCLA campus, these findings may hopefully guide future decision-making regarding how to address the mental health of UCLA's student and faculty populations.

Tables and Figures

Table 1. Demographics

Variable	N	%
Total Surveys	331	100%
Age (n, mean[std])	305	28 (12)
Gender		
Male	100	32%
Female	210	68%
Race		
White	117	38%
Hispanic/Latino	44	14%
Black or African American	13	4%
Asian/Pacific Islander	112	36%
Other	21	7%
Affiliation		
Undergrad	77	33%
Graduate Student	107	47%
Faculty	9	4%
Staff	26	11%
None	11	5%
Location		
Alumni Association	7	2%
Bplate	61	19%
CHS	130	40%
Law School	40	12%
Powell	11	3%
Royce	11	3%
School of Law	27	8%
Young Research Library	36	11%

Table 2. Survey administrated to participants after lunch-time live music performance.

Age: _____
 Gender: Male | Female | Other
 Ethnicity: White | Hispanic or Latino | Black or African American |
 Asian or Pacific Islander | Other
 Affiliation with the university: Undergraduate Student | Graduate Student | Faculty | Staff | None

Please rate your level of stress	None/minimal	Mild	Moderate	Severe
1. Before lunch	0	1	2	3
2. After lunch	0	1	2	3

	Never	Almost never	Sometimes	Fairly often	Very often
3. In the last month, how often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
4. In the last month, how often have you felt confident about your ability to handle your personal problems?	0	1	2	3	4
5. In the last month, how often have you felt that things were going your way?	0	1	2	3	4
6. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

Table 3. Breakdown of survey responses

	In the last month, how often have you felt that you were unable to control the important things in your life?		In the last month, how often have you felt confident about your ability to handle your personal problems?		In the last month, how often have you felt that things were going your way?		In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	
Never (0)	26	8%	4	1%	5	2%	41	13%
Almost never (1)	83	26%	12	4%	22	7%	101	31%
Sometimes (2)	145	45%	76	24%	103	32%	128	40%
Fairly often (3)	49	15%	152	47%	151	47%	31	10%
Very often (4)	19	6%	78	24%	41	13%	21	7%
Mean (std)	1.85	0.97	2.89	0.85	2.62	0.85	1.66	1.03

Table 4. Stress composite index by demographic characteristics.

	Mean ¹	Std	Chi-Square	DF	P-Value ²
Total Cohort	1.5	0.68			
Age					
>24 years	1.5	0.69	0.29	1	0.59
<=24 years	1.45	0.67			
Gender					
Male	1.45	0.73	0.84	1	0.36
Female	1.52	0.66			
Race					
White	1.35	0.68	14.85	4	0.005
Hispanic/Latino	1.45	0.66			
Black or African American	1.81	0.47			
Asian/Pacific Islander	1.56	0.68			
Other	1.86	0.65			
Affiliation					
Undergrad	1.55	0.69	3.46	4	0.48
Graduate Student	1.42	0.64			
Faculty	1.64	0.69			
Staff	1.55	0.75			
None	1.75	0.96			
Location					
Alumni Association	1.68	0.98	16.26	7	0.02
Bplate	1.50	0.68			
CHS	1.37	0.64			
Law School	1.60	0.67			
Powell	2.09	0.52			

Royce	1.36	0.53
School of Law Young Research Library	1.46	0.7
	1.71	0.77

¹Scores for questions 4 and 5 used reverse coding, so that higher scores correspond to increased stress, consistent with questions 3 and 6.

²Wilcoxon Rank-Sum or Kruskal Wallis test used to compare stress between groups.

Table 5. Regression model predicting average stress

Variable	Estimate	Standard Error	t-value	P-value
Race				
White	REF ¹	REF	REF	REF
Hispanic/Latino	0.1	0.12	0.84	0.4
Black or African American	0.46	0.2	2.26	0.02
Asian/Pacific Islander	0.2	0.09	2.27	0.02
Other	0.5	0.16	3.17	0.002
R-square	0.05			
DF = 4,301				

Variable	Estimate	Standard Error	t-value	P-value
Location				
Alumni Association	0.3	0.06	1.16	0.25
Bplate	0.12	0.11	1.16	0.28
CHS	REF	REF	REF	REF
Law School	0.14	0.13	1.08	0.28
Powell	0.72	0.21	3.39	0.0008
Royce	0.05	0.22	0.23	0.82
School of Law Young Research Library	0.09	0.14	0.62	0.54
	0.34	0.13	2.68	0.0079
R-square	0.05			
DF = 7,298				

¹REF = reference group

Figure 1. Paired analysis of stress levels before and after lunch

	Before Lunch		After Lunch		Difference
	N	%	N	%	
None	36	11%	102	32%	
Mild	95	30%	166	52%	
Moderate	164	51%	47	15%	
Severe	26	8%	4	1%	
Mean, Std	1.56	0.80	0.85	0.71	0.70 (0.72)

DF = 317, t-value = 17.35, P < 0.0001

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