Effects of Relaxing Music on Salivary Cortisol Level after Psychological Stress

STÉPHANIE KHALFA,[a] SIMONE DALLA BELLA,[b] MATHIEU ROY,[c] ISABELLE PERETZ,[c] AND SONIA J. LUPIEN[d]

[a]*Laboratory of Neurophysiology and Neuropsychology, INSERM EMI-U 9926, Université de la Méditerranée, Faculté de Médecine Timone, 13385 Marseille cedex 05, France*

[b]*Department of Psychology, Ohio State University, Columbus, Ohio 43210, USA*

[c]*Laboratory of Music Neuropsychology and Auditory Cognition, University of Montreal, and Department of Psychology CP 6128 Succursale Centre-Ville Montréal H3C 3J7 Quebec, Canada*

[d]*Laboratory of Human Psychoneuroendocrine Research, Douglas Hospital Research Center, and McGill University, Department of Psychiatry, Verdun H4H 1R3 Quebec, Canada*

ABSTRACT: The goal of the present study was to determine whether relaxing music (as compared to silence) might facilitate recovery from a psychologically stressful task. To this aim, changes in salivary cortisol levels were regularly monitored in 24 students before and after the Trier Social Stress Test. The data show that in the presence of music, the salivary cortisol level ceased to increase after the stressor, whereas in silence it continued to increase for 30 minutes.

KEYWORDS: cortisol; stress; music; emotion; relaxation; anxiety

INTRODUCTION

Music is a powerful tool in evoking emotions.[1] Musical experience in everyday life results in a more positive and happier disposition in many individuals.[2] By extension, listening to music can be effective in reducing the negative effects of stress. Supportive evidence can be found in the observation that listening to music resulted in a marked reduction in salivary cortisol levels in patients exposed to presurgical stress.[3] The purpose of this study was to replicate this finding in a nonmedical setting.

Address for correspondence: Dr. Stéphanie Khalfa, Laboratory of Neurophysiology and Neuropsychology, INSERM EMI-U 9926, Université de la Méditerranée, Faculté de Médecine Timone, 27, Bd Jean Moulin, 13385 Marseille cedex 05, France. Voice: (33)-04-91-29-98-15; fax: (33)-04-91-78-99-14.
skhalfa@skhalfa.com

Ann. N.Y. Acad. Sci. 999: 374–376 (2003). © 2003 New York Academy of Sciences.
doi: 10.1196/annals.1284.045

METHODS

Twenty-four francophone male university students were evaluated before and after the Trier Social Stress Test (TSST).[3] The test is a validated stress task known to induce significant increases in cortisol levels.[4] It consists of a speaking task and mental calculations performed in front of an audience. The sampling of salivary cortisol was undertaken 20 and 30 minutes after the subject's arrival (in the afternoon) and served as a baseline. Next, subjects prepared their speech for 10 minutes (anticipation phase). At the end of this phase and of the TSST, two other samples were collected. Afterwards, a sample was taken every 15 minutes until the end of the 45-minute stress recovery period (FIG. 1). During this time, the students were comfortably seated and were asked to relax in silence or with a musical tape being played. The tape was a concatenation of 10 relaxing excerpts from Enya, Vangelis, and Yanni and was delivered via loudspeakers. The salivary cortisol response to the stress was absent in seven subjects; they were eliminated from the analyses. The silence group was comprised of eight subjects (mean age 23.8 years ± 3.3), and the music group was comprised of nine subjects (mean age 24 years ± 4.2). The experiment was conducted with the full understanding and consent of each participant.

RESULTS

The variations in mean salivary cortisol levels for each group are shown in FIGURE 1. There were no significant differences in cortisol levels between the silence

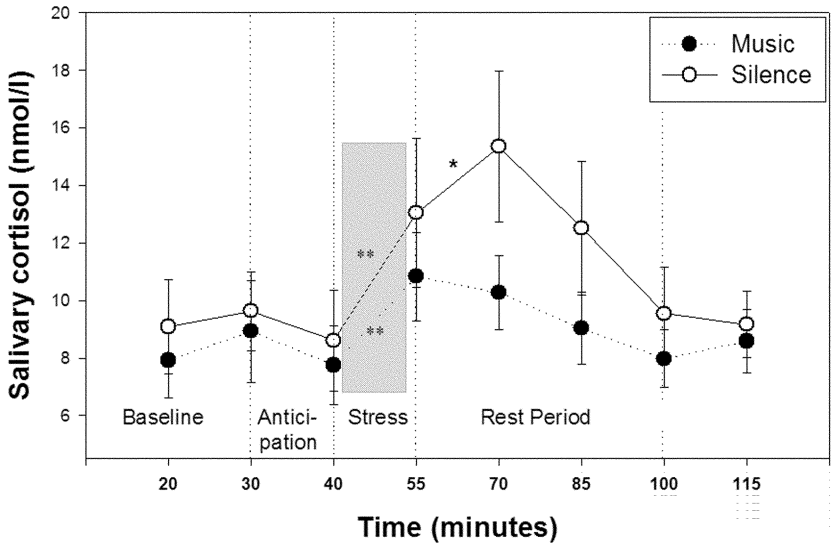

FIGURE 1. Means and standard errors of salivary cortisol concentration from 20 to 115 minutes after subjects' arrival; $^{**}P < 0.01$; $^{*}P < 0.05$.

and music groups during the baseline period. Also, both groups displayed a significant increase in salivary cortisol levels in response to the TSST (silence: $t(8) = 3.3$; $P < 0.01$; music: $t(7) = 8.2$; $P < 0.001$), and there was no group effect with regard to the magnitude of the cortisol response to the stressor. However, after the stressor and in the first part of the stress recovery period (time 70 of the protocol), salivary cortisol levels continued to increase in the silence group ($t(8) = 2.3$; $P < 05$), whereas they did not in the music group ($P > 0.1$). Following the rest period, salivary cortisol levels returned to baseline levels in both groups.

DISCUSSION

The psychological stressor provoked a strong emotion that was revealed by a sharp increase in cortisol levels within 15 minutes. The concentration of cortisol decreased more rapidly in the saliva of the subjects exposed to music than in the group recovering from stress in silence, suggesting that relaxing music after a stressor can act by decreasing the poststress response of the hypothalamic-pituitary-adrenal axis. This result replicates previous findings,[4,5] indicating that relaxing music is more effective than silence in decreasing cortisol levels after stress induction. Further studies are necessary to determine if the effect of relaxing music on the stress recovery period is specific to music or can be obtained with different stimuli.

ACKNOWLEDGMENTS

This research was supported by fellowships from the Canadian Institutes of Health Research and from the education government of Quebec (to S.K.) and the REPAR section of the Fonds de la Recherche en Santé du Québec (to M.R.) and by a grant from the Natural Science and Engineering Research Council (to I.P.).

REFERENCES

1. GOLDSTEIN, A. 1980. Thrills in response to music and other stimuli. Physiol. Psychol. **8:** 126–129.
2. SLOBODA, J.A. & S.A. O'NEILL. 2001. Emotions in everyday listening to music. *In* Music and Emotions. Theory and Research. P.N. Juslin & J.A. Sloboda, Eds. :415–429. Oxford University Press. Cambridge.
3. MILUK-KOLASA, B., Z. OBMINSKI, R. STUPNICKI & L. GOLEC. 1994. Effects of music treatment on salivary cortisol in patients exposed to pre-surgical stress. Exp. Clin. Endocrinol. **102:** 118–120.
4. KIRSCHBAUM, C. & D.H. HELLHAMMER. 1993. The "Trier Social Stress Test": a tool for investigating psychobiology stress responses in a laboratory setting. Neuropsychobiology **28:** 76–81.
5. KIRSCHBAUM, C. & D.H. HELLHAMMER. 1994. Salivary cortisol in psychoneuroendocrine research: recent developments and applications. Psychoneuroendocrinology **19:** 313–333.