



The stress-reducing effect of music listening varies depending on the social context



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ABSTRACT

Objective: Given that music listening often occurs in a social context, and given that social support can be associated with a stress-reducing effect, it was tested whether the mere presence of others while listening to music enhances the stress-reducing effect of listening to music.

Methods: A total of 53 participants responded to questions on stress, presence of others, and music listening five times per day (30 min after awakening, 1100 h, 1400 h, 1800 h, 2100 h) for seven consecutive days. After each assessment, participants were asked to collect a saliva sample for the later analysis of salivary cortisol (as a marker for the hypothalamic-pituitary-adrenal axis) and salivary alpha-amylase (as a marker for the autonomic nervous system).

Results: Hierarchical linear modeling revealed that music listening per se was not associated with a stress-reducing effect. However, listening to music in the presence of others led to decreased subjective stress levels, attenuated secretion of salivary cortisol, and higher activity of salivary alpha-amylase. When listening to music alone, music that was listened to for the reason of relaxation predicted lower subjective stress.

Conclusion: The stress-reducing effect of music listening in daily life varies depending on the presence of others. Music listening in the presence of others enhanced the stress-reducing effect of music listening independently of reasons for music listening. Solitary music listening was stress-reducing when relaxation was stated as the reason for music listening. Thus, in daily life, music listening can be used for stress reduction purposes, with the greatest success when it occurs in the presence of others or when it is deliberately listened to for the reason of relaxation.

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1. Introduction

Music listening is a popular activity of daily life (North et al., 2004). As there is accumulating evidence that music listening in daily life is associated with beneficial effects for well-being and health, it is of utmost importance to study the effects of music listening in daily life, i.e. in a setting characterized by high ecological validity. Sloboda et al. (2001) were pioneers in this area of research in that they conducted the first ecological momentary assessment study which directly investigated participants and their music listening behaviors in their daily lives. In addition to descriptive data on situations in which music was listened to, Sloboda et al. (2001) were able to show that music listening in daily life was associated

with beneficial effects on mood. This finding is in line with other studies set in daily life, which found that music listening was associated with the experience of positive emotions (Juslin et al., 2008; van Goethem and Sloboda, 2011). Furthermore, studies not only point towards beneficial effects for mood and well-being in healthy populations, but also towards favorable effects on various disease states (Batt-Rawden et al., 2005; Linnemann et al., 2015b; Särkämö et al., 2008).

However, the underlying psychophysiological mechanisms for these beneficial effects remain unclear. We hypothesize that beneficial effects of music listening on health are mediated by a psychophysiological stress reduction (Thoma and Nater, 2011). This is in line with evidence from recent neuroimaging studies. Music-evoked emotions are associated with activity in core emotion networks (Koelsch, 2014). Two brain structures that are involved in music-induced emotions are the hippocampus and the amygdala (Koelsch, 2014), which are both known to be involved in regulating the hypothalamic-pituitary-adrenal (HPA) axis (Tsigos

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and Chrousos, 2002). The HPA axis is one of the prominent stress systems in the body. An activation of this axis can be indirectly measured by the secretion of the hormone cortisol (Hellhammer et al., 2009). Indeed, music listening (in experimental contexts) has previously been linked to the secretion of cortisol, although the reported results are inconsistent (for an overview, see: Chanda and Levitin, 2013; Kreutz et al., 2012; Thoma and Nater, 2011). For example, studies investigating the effects of relaxing music on HPA axis activity either found reduced cortisol secretion or no effect (Chanda and Levitin, 2013). When studying the effects of stimulating music, both lower and higher cortisol secretion have been found (Chanda and Levitin, 2013). These inconsistencies might partly arise from heterogeneous methodologies, as the studies vary with regard to who had control over choice of music (self-selected versus experimenter-selected) and what kind of music was listened to (Chanda and Levitin, 2013). Another prominent stress-sensitive system in the body is the autonomic nervous system (ANS), which has also been implicated in mediating music-induced physiological changes (Hodges, 2011). Its activation can be indirectly measured by the secretion of the salivary enzyme alpha-amylase (Nater and Rohleder, 2009). Using this enzyme as an autonomic stress marker, subjects listening to music prior to stress have been shown to recover faster after exposure to a psychosocial stressor as compared to non-music control conditions (Thoma et al., 2013).

However, most of the findings examining mechanisms underlying the beneficial effects of music listening were gathered in experimental settings. The number of studies set in daily life is still limited. We were able to show that music listening in daily life affects psychophysiological stress as measured by salivary cortisol and salivary alpha-amylase (Linnemann et al., 2015a). In this study, different features of the music itself (e.g., valence and arousal of the music) but also nonmusical context factors (e.g., reasons for music listening) contributed to the stress-reducing effect of listening to music (Linnemann et al., 2015a). In particular, reasons for music listening predicted stress reduction. Listening to music for the reason of relaxation reduced both subjective and physiological parameters of stress in a sample of healthy participants (Linnemann et al., 2015a), and it increased control over pain in patients with fibromyalgia (Linnemann et al., 2015b).

As promising as these results might be, so far, most of the research on the stress-reducing effect of music listening focused on individuals listening to music in solitude. However, the social context is especially relevant, as music listening is thought to fulfill social functions (Boer and Abubakar, 2014; Hargreaves and North, 1999; Koelsch, 2013), and research addressing this factor is still in its infancy (Hargreaves and North, 1999). Furthermore, most of the studies concentrated on musical group activities (e.g. singing; Valentine and Evans, 2001), leaving the question of any beneficial effect of mere music listening unanswered. There is evidence from the literature that at least some of the beneficial effects of music listening are closely linked to its social functions. In a questionnaire study, Boer and Abubakar (2014) showed that listening to music with peers was positively associated with continuous measures of well-being and social cohesion. In an experimental study, in which participants were seated next to each other in rocking chairs and were asked to rock at a comfortable rate, Demos et al. (2012) found that those participants who synchronized their rate of rocking to music (as opposed to visual information) felt more connected to the other person. Studies set in daily life found that music listening in the presence of others evoked more positive emotions than music listening in solitude (Juslin et al., 2008). Consequently, there is evidence that in the presence of others, the beneficial effects of music on emotional well-being and social cohesion are enhanced, but little is known about whether this effect also translates into enhancing the stress-reducing effect of listening to music.

Empirical evidence on stress (beyond the scope of music listening) consistently shows that social support has a stress-buffering function (Cohen and Wills, 1985). Translating these findings to the stress-reducing effect of music listening, it seems quite reasonable to assume a relevant role of the social context of listening to music. Experimental studies investigating the social context of musical activities focus on synchronization between the actors (e.g., Mercadie et al., 2014), but the question arises whether the mere presence of others can yield beneficial effects as well. Although there is accumulating evidence from the stress literature that the presence of others affects stress levels (for a review, see: Seeman and McEwen, 1996), there is no evidence regarding whether this can be generalized to the stress-reducing effect of music listening. Furthermore, it does not seem to be the mere presence of others that is stress-reducing per se; rather, the familiarity of the people present may play a crucial role in this effect (Allen et al., 1991). Kessel (1965) showed that the stress-reducing effect of the presence of others is even more profound if friends are present in contrast to strangers. Kirschbaum et al. (1995) found that this effect might be sex-specific, with men benefitting more from partner support than women. According to Ditzen et al. (2007), the kind of support that is provided appears to be important, as supporters who performed a massage were more effective than supporters who provided verbal support. However, all of these results were mainly found in laboratory studies set in highly artificial surroundings with low ecological validity. The question arises whether listening to music in the presence of others can act as a source of support, and whether it enhances the stress-reducing effect of listening to music.

1.1. Research question

It is hypothesized that the presence of others while listening to music enhances the stress-reducing effect of listening to music (Hypothesis 1). This hypothesis is tested by means of an ambulatory assessment design encompassing both subjective stress as well as parameters of biological stress-responsive systems. Furthermore, it is hypothesized that the familiarity of the people present moderates this effect, with further attenuated stress levels when music is listened to in the presence of friends (Hypothesis 2). As listening to music for the reason of relaxation was found to be predictive of the stress-reducing effect of listening to music in previous studies, it was tested, in an exploratory manner, whether this stress-reducing effect of listening to music for the reason of relaxation varies depending on the presence of others.

2. Method

2.1. Participants

Participants were recruited from various sources, such as emails sent to university mailing lists and a notice on a bulletin board for psychological studies. A total of 53 healthy young subjects (32 female, 21 male) participated in the study. Participants' age ranged from 20 to 32 years with a mean of $\bar{x}=23.32$ ($SD=3.08$) years. All participants had a BMI < 30, were either non-smokers or smoked less than five cigarettes per week, did not consume drugs (no consumption of cannabis within the last two weeks, no consumption of any other psychotropic substances within the last four weeks), did not take any medication (except for hormonal contraceptives), and had no chronic somatic or psychiatric disease (according to self-reports based on the Patient Health Questionnaire (PHQ; Löwe et al., 2002)). They received either 40 Euro or course credit as reimbursement. The study has been approved by the local IRB.

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