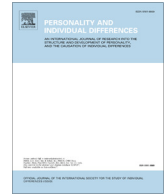




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Noise sensitivity, handedness, and the occurrence of high perceived anxiety and depression in young adults



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ABSTRACT

Objective: The aim was to explore the association between handedness and noise sensitivity, with possible implications on the occurrence of high perceived anxiety and depression in young healthy adults.

Methods: A cross-sectional study comprised 1113 persons, 400 men and 713 women, aged 21.44 ± 2.11 years. According to Edinburgh Handedness Inventory, participants were classified as: strongly left-handed, weakly left-handed, weakly right-handed, and strongly right-handed. Noise sensitivity was measured with Weinstein's scale. Perceived anxiety and depression were measured using Hamilton Anxiety Rating Scale, and Hamilton Depression Rating Scale, respectively.

Results: Noise sensitivity depends on one's age. Noise sensitivity increased the odds of high perceived anxiety (Odds Ratio = 1.031; 95% Confidence Interval = 1.023–1.034) and depression (OR = 1.030; 95% CI = 1.022–1.038), independently from age, gender and handedness. Being weakly right-handed and weakly left-handed was associated with higher odds of depression in comparison to being strongly right-handed.

Conclusions: Noise sensitive persons were at higher risk of high perceived anxiety and depression. Weakly right-handed and weakly left-handed persons were at higher risk of depression, independently from noise sensitivity.

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1. Introduction

Noise sensitivity refers to one's internal physiological, psychological or lifestyle-related states which increase the degree of reactivity to noise in general (Job, 1999). Noise sensitivity is a relatively stable personality trait independent from noise exposure (Miedema & Vos, 2003; Stansfeld, Haines, Burr, Berry, & Lercher, 2000; Van Kamp et al., 2004). It is generally considered a factor that mediates or modifies the effects of noise exposure on noise annoyance (Belojevic & Jakovljevic, 2001; Fyhri & Klæboe, 2009; Job, 1999; Miedema & Vos, 2003; Paunovic, Jakovljevic, & Belojevic, 2009; Schreckenber, Griefahn, & Meis, 2010; Stansfeld, Sharp, Gallacher, & Babisch, 1993). In addition, noise sensitivity is associated with self-reported physical health (Schreckenber et al., 2010), subjective health complaints (Fyhri & Klæboe, 2009), some physical and mental health complaints (Hill, Billington, & Krägeloh, 2014), psychological disorders (Stansfeld et al., 1993), impaired cognitive functions and

schizophrenia (Wright, Peters, Ettinger, Kuipers, & Kumari, 2014), cardiovascular mortality among women (Heinonen-Guzejev et al., 2007), perceived quality of life (Welch, Shepherd, Dirks, McBride, & Marsh, 2013), as well as with poor environmental quality in one's residential area (Schreckenber et al., 2010).

Handedness refers to the hand preferentially used for fine motor activity, when only one hand is required (Uzoigwe, 2013). Generally, four patterns of handedness can be recognized. In most cases persons use only one hand predominantly; they are referred to as either right-handed or left-handed. Mixed-handed persons use different hands for different tasks, whereas ambidexterity persons use each hand equally well for all tasks; these two forms are usually considered as one (Uzoigwe, 2013). Handedness is influenced by many genetic, hormonal, developmental and cultural factors (Llaurens, Raymond, & Faurie, 2009). Many aspects of hand preference, such as its evolution, etiology, geographical variations, proportion in various societies and across time remain currently unexplained (Llaurens et al., 2009; Medland, Perelle, De Monte, & Ehrman, 2004; Uzoigwe, 2013). Although it may seem that the social tolerance to left-handed individuals has increased, some sort of concealed bias against them exists in many societies (Dragović, Badcock, Milenković, Gregurović, & Šram, 2013).

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To the authors' knowledge, the association between handedness and noise sensitivity has not been taken into consideration. The two entities may be related via some common denominator, such as neuroticism. Neuroticism, a personality trait, was significantly related to noise sensitivity in many studies (Belojević & Jakovljević, 2001; Belojević, Jakovljević, & Slepčević, 2003; Heinonen-Guzejev et al., 2012; Hill et al., 2014; Öhrström, Bjorkman, & Rylander, 1988). As for the association between neuroticism and handedness, the findings are somewhat controversial. In an older study, left-handed and mixed-handed men had higher neuroticism scores in comparison to right-handed men (Mascie-Taylor, 1981). In a recent study, however, left-handed and right-handed persons shared similar scores on several personality dimensions, including neuroticism (Beratis, Rabavilas, Papadimitriou, & Papageorgiou, 2011). Nevertheless, our recent study on adult urban population showed that neurotic disturbances were more common among the left-handed males compared to the right-handers (Milenković, Brkić, & Belojević, 2013). In addition, neuroticism was strongly associated with psychoticism, paranoid ideation, interpersonal sensitivity, phobic anxiety, and somatisation in left-handed, but not in right-handed persons (Beratis et al., 2011).

The high proportion of left-handed persons was found among patients with schizophrenia (Dragović & Hammond, 2005), among persons with substance addictions (Yüksel, Sengezer, Dilbaz, & Dane, 2012), and among convicted criminals (Bogaert, 2001). Similarly, the proportion of left-handed children referred for psychiatric evaluation exceeded the national average rate in the USA (Logue, Logue, Kaufmann, & Belcher, 2015). These studies imply that some of these conditions may occur as a consequence of biological or developmental abnormalities in brain lateralization (Bogaert, 2001; Dane et al., 2009; Yüksel et al., 2012).

Furthermore, anxiety and depression may be related to noise sensitivity (Kishikawa et al., 2009) and/or to left-handedness (Logue et al., 2015; Lyle, Chapman, & Hatton, 2013; Wright & Hardie, 2012).

We hypothesized that handedness may be related to noise sensitivity by means of neuroticism. The association may be independent from age, gender, handedness of other family members, and forced use of right hand in childhood. Our assessment may help understand the impact of handedness on the sensitivity to noise and possibly other environmental stressors. The aim of this study was to explore the association between handedness and noise sensitivity, with possible implications on the occurrence of high perceived anxiety and depression in young healthy adults.

2. Methods

2.1. Participants

This cross-sectional study was performed at the Faculty of Medicine, University of Belgrade from January to December 2013. All first- and second-year medical students were approached to participate in the study. In total, 1200 questionnaires were distributed, and 1190 were filled out and returned (response rate 99%). Persons who failed to answer all questions ($n = 77$) were excluded from the study. The final sample, therefore, comprised 1113 participants, 400 men and 713 women, aged 21.44 ± 2.11 years. The study was approved by the Ethics Committee of the Faculty of Medicine, University of Belgrade.

2.2. Materials

The anonymous questionnaire included general socio-demographic data: age and gender. Furthermore, participants were asked if their mothers, fathers, and siblings were left-handed (all

tree variables were coded as: yes vs. no), and whether they were forced to use right hand in childhood (yes vs. no).

Hand preference or handedness was assessed using the Edinburgh Handedness Inventory (Oldfield, 1971). It is a 10-item scale relating to the use of hands in different every-day situations. Each item can be answered on a 4-point scale corresponding to the strength of right or left hand preference for a given task (minimum score equals -100 , maximum score equals $+100$). The cut-off scores for the Edinburgh Handedness Inventory were previously defined (Oldfield, 1971).

Subjective noise sensitivity was measured with Weinstein's Noise Sensitivity Scale (Weinstein, 1978). It is a 21-item, 6-point scale dealing with attitudes toward noise in general, and emotional reactions to a variety of sounds (minimum score equals 21, maximum score equals 126) (Weinstein, 1978).

Perceived anxiety level was measured using Hamilton Anxiety Rating Scale (HAM-A), Serbian version (Biro, Smederevac, & Novovic, 2009). It is a 29-item, 5-point scale covering somatic and psychic symptoms of anxiety (minimum score equals 0, maximum score equals 116). Perceived depression level was measured using Hamilton Depression Rating Scale (HAM-D), Serbian version (Biro et al., 2009). It is a 20-item, 5-point scale covering somatic and psychic symptoms of depression (minimum score equals 0, maximum score equals 80).

2.3. Procedure

Participants were approached at class during working days. They were asked to fulfill the questionnaire including all the above-mentioned tests. For the purpose of this study, four handedness categories were defined as follows: 'strongly left-handed' if their handedness score ranged from -100 to -71 , 'weakly left-handed' if they scored from -70 to 0, 'weakly right-handed' if they scored from 0 to $+70$, and as 'strongly right-handed' if scored from $+71$ to $+100$. This classification was applied to take into account the direction of handedness (left vs. right) as well as the strength of handedness (weak vs. strong).

2.4. Statistical analysis

Descriptive statistic was presented as mean values \pm standard deviation (SD) for numeric variables, or as percents (relative numbers) for categorical variables. The scores obtained from noise sensitivity scale, perceived anxiety scale, perceived depression scale, and handedness scale were tested by Kolmogorov-Smirnov test; noise sensitivity scale was the only one whose distribution corresponded to the normal distribution. Differences between four handedness groups were tested with one-way ANOVA for parametric data, and Chi-square test and Kruskal Wallis test for nonparametric data. Linear regression was applied to assess the relationship between noise sensitivity score and independent variables, such as age, gender, and handedness score. As a result, an estimated change of noise sensitivity score for a unit of outcome variables was estimated upon control of all independent variables in the models. Perceived anxiety scores and perceived depression scores remained skewed after logarithmic transformation; the variables were thus dichotomized according to median values into 'high vs. low perceived anxiety', and 'high vs. low perceived depression'. Multiple logistic regression analysis was used to compute adjusted Odds Ratios for high perceived anxiety and high perceived depression in relation to age, gender, noise sensitivity score and handedness categories. A probability level of less than 0.05 was accepted as significant. The authors used SPSS 15.0 for Windows software (SPSS Inc. 1989–2006).

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