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Is Transportation Noise Associated With Obesity?

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Abstract

The study aims to examine the association between exposure to traffic noise and markers of obesity in university students. The sample comprised of 484 university students, 25.6% males and 74,4% females, mean age 22.9±2 years, 188 (38.8%) living in the dormitory exposed to road traffic noise and 296 (61.2%) living in the dormitory not exposed to traffic noise − the control one. Equivalent noise levels were assessed for both the control and exposed groups by a hand-held sound level analyzer. Students from the exposed group are more annoyed by road traffic noise, disturbing their sleep and causing awakening. From obesity markers, the percentage of body fat assessed by the NIR (Near Infrared Radiation) method has the tendency to be positively associated with the traffic noise exposure in multiple linear and logistic regression (*beta* = 1.320, p=0.02, r^2=0.14; AOR= 1.76; 95 % CI=1.77-2.66), after adjustment for gender and the other behavioral, psychosocial and nutritional factors presented in the complex variable the Cardiovascular Risk Score. The limitations of the study are the young age, the short duration of the stay in the dormitory and the relatively small sample size. Future research is necessary to overcome these limitations and extend its inferences to the general population.

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Keywords: Road traffic noise; sound-level analyzer; obesity markers; university students

1. Introduction

Road traffic noise has been found to be associated with endocrine changes and cardiovascular disease. Increased cortisol level and chronic sleep problems may increase the risk of obesity according to some recent studies [1, 2, 3]. Acute and chronic sleep restriction has been shown to be associated with inadequate pancreatic insulin secretion,

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decreased insulin sensitivity, changes in appetite regulating hormones, and increased sympathetic tone and venous endothelial dysfunction. Short sleep duration is associated with reduction of serum leptin and elevation of ghrelin, leading to an increased appetite and reduced energy expenditure [1, 4]. The activation of the Hypothalamic-Pituitary-Adrenal axis results in elevated levels of cortisol, which promotes central fat deposition and impaired glucose regulation [5]. The other health effects which are partly stress related are hypertension and type 2 diabetes [6, 7]. The evidence is very limited for obesity by now, although the public health implications may be important.

2. Aim of the study

The study is aimed to examine the association between exposure to traffic noise and markers of obesity in the vulnerable group of young adults at the age of 19-25 years old − university students.

3. Methods

3.1. Exposure assessment

Equivalent noise levels were assessed for both the control and exposed groups (dormitories) in the Slovakian capital, Bratislava, by hand-held sound level analyzer. All measurements were recorded with standard methods during the time intervals from 17.00-18.00 and from 20.00-21.00 in the exposed and at the same time in the control area. This time interval was chosen to record the afternoon traffic peak and to detect the time most disturbing for students and for their activities (studying, watching TV, talking, relaxing, and falling asleep). Measurements were recorded during the spring season during working days (Tuesday) two times on each site. Road traffic flow composition was assessed as well. The L_{DEN} was estimated from the Bratislava agglomeration strategic noise map [8].

3.2. Sample

The sample comprised of 484 university students, 25.6% males and 74,4% females, mean age 22.9±2 years, 188 (38.8%) living in the dormitory exposed to road traffic noise and 296 (61.2%) living in the dormitory not exposed to traffic noise - the control one. The students did not differ significantly by gender and life style but they differed by age (females in the control group were older), length of stay in an apartment (longer in the control area) and by the exposure to several noise sources (besides traffic noise, also noise from neighbors and entertainment facilities).

3.3 Subjective Response and Questionnaires

Subjective response was assessed by the authorized „Noise annoyance questionnaire„ using a validated 5 grade noise annoyance verbal scale [9, 10]. The different sources of environmental noise were quantified. The validated 5 grade scale (Not at all; Slightly; Moderately; Very; Extremely), was developed and recommended by experts from the noise research ICBEN (The International Commission on the Biological Effects of Noise) team [10]. The questionnaire comprised personal (age, gender, education), behavioral (smoking, coffee and alcohol consumption), and questions focused on the characteristics of the residential environment (localization, construction and surrounding of residential buildings, the location and amenities of the apartment, window orientation to quiet and noisy streets and the length of stay in the apartment). It also included questions on possible non-auditory health effects (noise annoyance from different sources, interference with various activities and sleep disturbance) and subjective assessment of health troubles (headache, nervousness and irritability, difficulties falling asleep, the use of different types of medications, the presence cardiovascular diseases and overall assessment of the health status) [9].

The 24-hour dietary consumption and energy expenditure were assessed by a Food Frequency Questionnaire. The other important demographic, behavioral and psychosocial factors (age, gender, family history, hormonal contraception use, perceived psychogenic stress, smoking, alcohol consumption, etc.), blood pressure and cholesterol