

A laboratory study on the impact of tyre noise on sleep, cognition and blood metabolome

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ABSTRACT

Within the EU-project Low particle Emissions and IOw Noise Tyres (LEON-T), we experimentally investigated the effects of nocturnal tyre noise on sleep and the subsequent changes in indicators of cognitive and cardiometabolic function. In the first in a series of studies, fifteen young healthy participants (8 women; mean±SD age 22.4±3.0 years) slept for six consecutive nights in acoustically isolated bedrooms. They were exposed to nocturnal tyre noise of varying level (35 or 40 dB(A) L_{night} at the pillow) and traffic composition (continuous or intermittent [96 discrete events]). Sleep was measured with polysomnography and daily questionnaires. Questionnaires further included items on disturbance, restoration, and affect. Cardiovascular response was measured with electrocardiography and finger photoplethysmography. Blood samples were collected every morning for metabolomics analysis. Cognitive performance across multiple domains was measured every morning and evening with a computerised test battery. Data are analysed in linear mixed models (random subject effect) adjusted for age, sex, noise sensitivity and time in study. Compared to quiet baseline, nights with tyre noise were followed by higher noise-induced sleep disturbance, higher fatigue, difficulty sleeping, worse sleep than usual, and perceived shallow sleep. Point estimates indicate that intermittent noise was more disturbing than continuous noise, particularly for 40 dB(A) L_{night} , although post-hoc differences between exposures were not statistically significant. There were no significant effects on subjective sleep quality, sleepiness, estimated sleep latency, number of recalled awakenings, or positive or negative affect. Further analyses are currently underway (physiologic sleep, cognition, metabolomics) and will be presented at the congress.

Keywords (3-6): Tyre noise, Sleep, Polysomnography, Metabolomics, Neurobehavioural function, Electrocardiography