Publication

Adverse impact of nocturnal transportation noise on glucose regulation in healthy young adults : effect of different noise scenarios

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BACKGROUND: Epidemiological evidence indicates an association between transportation noise exposure and a higher risk of developing type 2 diabetes. Sleep disturbances are thought to be one of the mechanisms as it is well established that a few nights of short or poor sleep impair glucose tolerance and insulin sensitivity in healthy good sleepers.OBJECTIVES: The present study aimed to determine the extent to which exposure to nocturnal transportation noise affects glucose metabolism, and whether it is related to noise-induced sleep alterations.METHODS: Twenty-one young healthy volunteers (nine women) participated in a six-day laboratory study starting with a noise-free baseline night, then four nights sleeping with randomly-presented transportation noise scenarios (three road and one railway noise scenario) with identical average sound level of 45dB but differing in eventfulness and ending with a noise-free recovery night. Sleep was measured by polysomnography. Glucose tolerance and insulin sensitivity were measured after the baseline, the last noise night and the recovery nights with an oral glucose tolerance test using Matsuda and Stumvoll insulin sensitivity indexes. Eleven participants were assigned a less eventful noise scenario during the last noise night (LE-group), while the other ten had a more eventful noise scenario (ME-group). Baseline metabolic and sleep variables between the two intervention groups were compared using a non-parametric Mann-Whitney U test while mixed models were used for repeated measure analysis.RESULTS: All participants had increased glucoseAUC (meanśSE, 14ś2%, p<0.0001) and insulinAUC (55ś10%, p<0.0001) after the last noise night compared to the baseline night. 2h-glucose level tended to increase only in the ME-group between baseline (5.1ś0.22mmolůL-1) and the last noise night (6.1ś0.39mmolůL-1, condition: p=0.001, interaction: p=0.08). Insulin sensitivity assessed with Matsuda and Stumvoll indexes respectively decreased by 7ś8% (p=0.001) and 9ś2% (p<0.0001) after four nights with transportation noise. Only participants in the LE-group showed beneficial effects of the noise-free recovery night on glucose regulation (relative change to baseline: glucoseAUC: 1ś2%, p=1.0 for LE-group and 18ś4%, p<0.0001 for ME-group; Stumvoll index: 3.2ś2.6%, p=1.0 for LE-group and 11ś2.5%, p=0.002 for ME-group). Sleep was mildly impaired with increased sleep latency of 8ś2min (<0.0001) and more cortical arousals per hour of sleep (1.8ś0.6arousals/h, p=0.01) during the last noise night compared to baseline. No significant associations between sleep measures and glucose tolerance and insulin sensitivity were found.CONCLUSION: In line with epidemiological findings, sleeping four nights with transportation noise impaired glucose tolerance and insulin sensitivity. Based on the presented sound exposure, the eventfulness of the noise scenarios seems to play an important role

for noise-induced alterations in glucose regulation. However, we could not confirm our hypothesis that transportation noise impairs glucose regulation via deterioration in sleep quality and quantity. Therefore, other factors, such as stress-related pathways, may need to be considered as potential triggers for noise-evoked glucose intolerance in future research.

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