

The Effects of Circadian Rhythms Change in High Latitudes

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Abstract : Nowadays, Arctic and Antarctic regions are distinguished to be one of the most important strategic resources for global development. Nonetheless, living conditions in Arctic regions still demand certain improvements. As soon as the region is rarely populated, one of the main points of interest is health accommodation of the people, who migrate to Arctic region for permanent and shift work. At Arctic and Antarctic latitudes, personnel face polar day and polar night conditions during the time of the year. It means that they are deprived of natural sunlight in winter season and have continuous daylight in summer. Firstly, the change in light intensity during 24-hours period due to migration affects circadian rhythms. Moreover, the controlled artificial light in winter is also an issue. The results of the recent studies on night shift medical professionals, who were exposed to permanent artificial light, have already demonstrated higher risks in cancer, depression, Alzheimer disease. Moreover, people exposed to frequent time zones change are also subjected to higher risks of heart attack and cancer. Thus, our main goals are to understand how high latitude work and living conditions can affect human health and how it can be prevented. In our study, we analyze molecular and cellular factors, which play important role in circadian rhythm change and distinguish main risk groups in people, migrating to high latitudes. The main well-studied index of circadian timing is melatonin or its metabolite 6-sulfatoxymelatonin. In low light intensity melatonin synthesis is disturbed and as a result human organism requires more time for sleep, which is still disregarded when it comes to working time organization. Lack of melatonin also causes shortage in serotonin production, which leads to higher depression risk. Melatonin is also known to inhibit oncogenes and increase apoptosis level in cells, the main factors for tumor growth, as well as circadian clock genes (for example Per2). Thus, people who work in high latitudes can be distinguished as a risk group for cancer diseases and demand more attention. Clock/Clock genes, known to be one of the main circadian clock regulators, decrease sensitivity of hypothalamus to estrogen and decrease glucose sensibility, which leads to premature aging and oestrous cycle disruption. Permanent light exposure also leads to accumulation superoxide dismutase and oxidative stress, which is one of the main factors for early dementia and Alzheimer disease. We propose a new screening system adjusted for people, migrating from middle to high latitudes and accommodation therapy. Screening is focused on melatonin and estrogen levels, sleep deprivation and neural disorders, depression level, cancer risks and heart and vascular disorders. Accommodation therapy includes different types artificial light exposure, additional melatonin and neuroprotectors. Preventive procedures can lead to increase of migration intensity to high latitudes and, as a result, the prosperity of Arctic region.

Keywords : circadian rhythm, high latitudes, melatonin, neuroprotectors

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