

The Effect of Common Daily Schedule on the Human Circadian Rhythms during the Polar Day on Svalbard: Field Study

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Abstract : Any Arctic visitor has to deal with extreme conditions, including constant light during the summer season or constant darkness during winter time. Light/dark cycle is the most powerful synchronizing signal for biological clock and the absence of daily dark period during the polar day can significantly alter the functional state of the internal clock. However, the inner clock can be synchronized by other zeitgebers such as physical activity, food intake or social interactions. Here, we investigated the effect of polar day on circadian clock of 10 researchers attending the polar base station in the Svalbard region during July. The data obtained on Svalbard were compared with the data obtained before the researchers left for the expedition (in the Czech Republic). To determine the state of circadian clock we used wrist actigraphy followed by sleep diaries, saliva, and buccal mucosa samples, both collected every 4 hours during 24h-interval to detect melatonin by radioimmunoassay and clock gene (PER1, BMAL1, NR1D1, DBP) mRNA levels by RT-qPCR. The clock gene expression was analyzed using cosinor analysis. From our results, it is apparent that the constant sunlight delayed melatonin onset and postponed the physical activity in the same order. Nevertheless, the clock gene expression displayed higher amplitude on Svalbard compared to the amplitude detected in the Czech Republic. These results have suggested that the common daily schedule at the Svalbard expedition can strengthen circadian rhythm in the environment that is lacking light/dark cycle. In conclusion, the constant sunlight delays melatonin onset, but it still maintains its rhythmic secretion. The effect of constant sunlight on circadian clock can be minimalized by common daily scheduled activity.

Keywords : actigraph, clock genes, human, melatonin, polar day

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