Comparison of mood and cognitive disorders induced by acute and chronic sleep deprivation in mice

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Sleep deprivation (SD) is an emerging avoidable condition which lead to many neurophysiological abnormalities in body. Sleep debt manifests in different forms such as behavioral, cellular, and hormonal changes

This experiment was designed to highlight cognitive and behavioral disruptions, neurotransmitter profile and relative mRNA expressions of glial cells, Alzheimer's disease (AD) related genes and circadian genes. Whereas cytokines related relative mRNA expressions were checked and further corroborated with ELISA in chronic and acute sleep deprivation .

Experimental Design:

Adult C57BL6/J mice aging 11-13 weeks were used (n=10). Animal were subjected to sleep deprivation with help of rotating bar apparatus (12-20RPM) from 9:30am to 5:30pm. Duration for acute sleep deprivation was 5 days whereas chronic sleep deprivation duration was 14 days.

Behavioral Tests: Novel object recognition test (NORT) , Open field test (OFT), elevated plus maze test (EPM), tail suspension test and sucrose preference test were performed to analyze behavioral effect of acute and chronic sleep deprivation on mood and cognition.

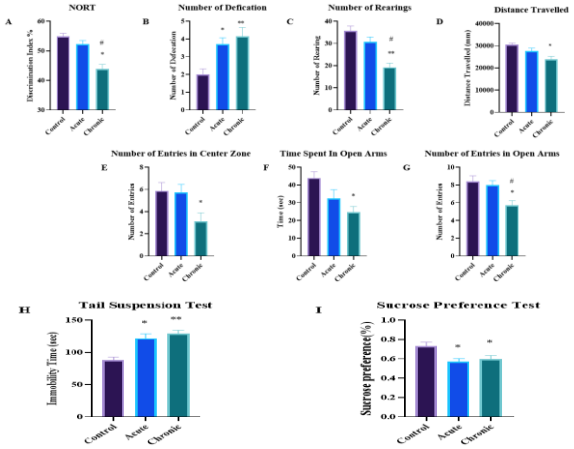

Figure 1. Chronic SD exhibited more detrimental behavioral effects when compared with control and acute. $^{*}p<0.1$, $^{**}p0.01$ compared against control; $^{\#}p<0.1$, $^{\#\#}p<0.01$ compared against acute SD group.

Neurotransmitter: Norepinephrine (NE), Dopamine (DA), 3,4-Dihydroxyphenylacetic acid (DOPAC), DOPAC/DA ratio, 5-hydroxytryptamine (5-HT), 5-Hydroxyindoleacetic acid (5-HIAA) and 5-HIAA/5-HT ratio was checked to with High performance liquid chromatography (HPLC)

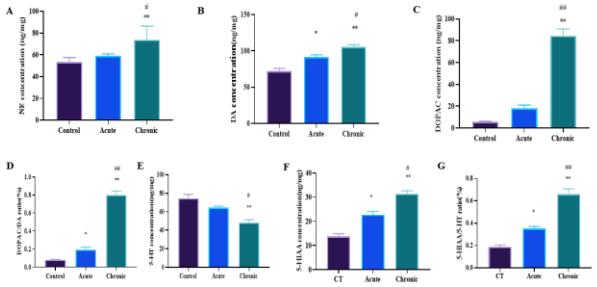

Figure 2. HPLC performed for neurotransmitters. $^{*}p<0.1$, $^{**}p<0.01$ compared to control, $^{\#}p<0.1$, $^{\#\#}p<0.01$ compared to acute SD group

QPCR: Glial cells, AD and circadian related relative mRNA expressions were checked with help of qPCR.

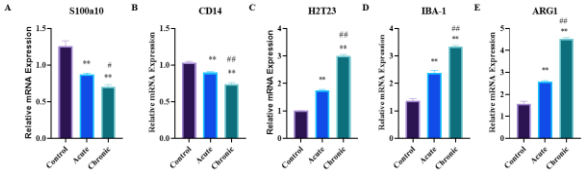

Figure 3a. Relative mRNA expressions for astrocyte subtypes (A1, A2) and microglia. $^{*}p<0.1$, $^{**}p0.01$ compared against control; $^{\#}p<0.1$, $^{\#\#}p<0.01$ compared against acute SD group.

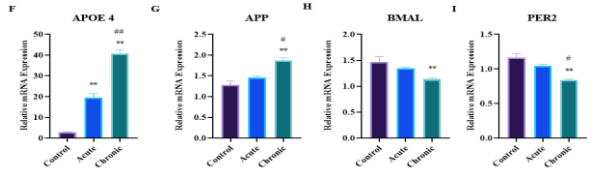

Figure 3b. AD and circadian rhythm related relative mRNA expressions. $^{*}p<0.1$, $^{**}p0.01$ compared against control; $^{\#}p<0.1$, $^{\#\#}p<0.01$ compared against acute SD group.

Cytokine Profile: Relative mRNA expressions were done for cytokines and results were further checked with help of ELISA.

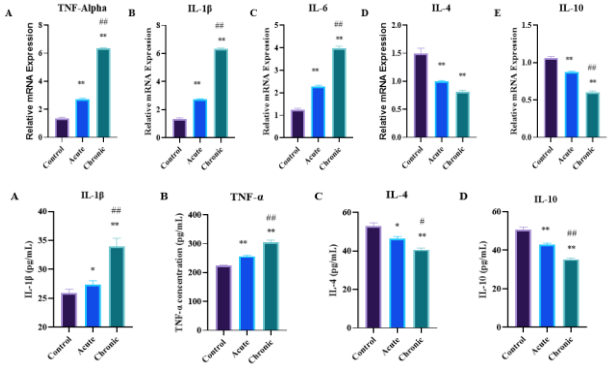

Figure 4a. Pro-inflammatory and anti-inflammatory relative mRNA expressions and **Figure 4b.** ELISA quantification. $^{*}p<0.1$, $^{**}p0.01$ compared against control; $^{\#}p<0.1$, $^{\#\#}p<0.01$ compared against acute SD group.

Conclusion: The results indicate that chronic SD has more detrimental effects than acute sleep. But interestingly, although acute sleep deprivation also exert the same detrimental effects, but behavioral signs are not always apparent in some cases.

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