Journal for ReAttach Therapy and Developmental Diversities
eISSN: 2589-7799
2022 June; 5 (1): 114-121

Association of Sleep Disorders and Mood State with Dopamine and Serotonin Levels in Alcoholism: A Psychological Comparative

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Received: 28-March-2022
Revised: 19-May-2022
Accepted: 30-May-2022

Abstract

The sleep disorder and mood state is affected by different factors, alcoholism is one of the important problem contributed on different health disorders, present study aims to assessment of sleep disorders and mood state with dopamine and serotonin level in alcoholism, results show a significant reduction in age, sleep duration, serotonin and dopamine and significant elevation of BMI, the sleep duration less than 5 hours was high percentage in alcoholism (63.41%) and more than 5 hours was lower in alcoholism (16.66%). three categories of mood state including bad, moderate and good mood were had (63.41, 12.19, 21.95)% respectively**.** all control group was has good mood (100%), the dopamin level shows in less than 5 hour category non-sig differences reduction in alcoholism (p 0.555), while significant elevation in control group (p 0.035). the serotonin level shows in less than 5 hours category non-sig decresed in the alcoholism (p 0.647), and non-sig elevation in control group (p 0.525)**.** The dopamine and serotonin levels according to mood state show significant differences (p 0.000) in dopamine level between mood state categories of alcoholism and control, but no significant differences within the alcoholism mood state categories**,** The serotonin level also shows significant differences among groups (p 0.005), its elevated in moderate mood of alcoholism and in good mood of control group**,** The correlation coefficient between dopamine and sleep duration was non-significant weak positive correlation (r 0.069, p 0.666), while in control group significant inverse correlation (r -.383, p 0.037). The correlation coefficient between serotonin and sleep duration shows non-significant weak positive association (r 0.016, p 0.921) in alcoholism group and in control group non-significant inverse correlation (r -0.279, p 0.135), the sleep time according to mood state shows non-significant differences in alcoholism mood state categories and significant with control group, Current finding concluded that the reduction in dopamine and serotonin reduction in alcoholism may be effected in the sleep duration and mood state

Keywords: sleep disorders; psychological comparative; mood state; serotonin levels

Introduction

The short and disturbed sleep is detected in one of the five adults in the world (1) this called as Insomnia symptoms which correlated with the some chronic health conditions as well as hypertension, diabetes, mood disorders and all-cause mortality (2-4).

Sleep, therefore, is a basic necessity of the human body and at the same time a basic prerequisite of its good health, in order its normal functions to be carried out. As a result, any sleep disorder has a direct impact on the body function, reducing its performance (5).

Evidences clarified that the association of alcohol abuse and sleep disorder is complex, despite of utilized alcohol for decreased sleep onset latency and as a sedative for relieve, studies found that alcohol consume lead to disrupts sleep(6) The longtime of alcohol abuse has been found to disrupt sleep quality and need to consume

more alcohol(7), Chakravorty et al., (8) suggested that The association between alcohol consume and sleep disorder may be bidirectional in nature.

The alcohol addiction lead to increased tolerance that accompanied with the neurotransmitter adaptation systems, consequently sleep regulation alteration (9).

In the central nervous system, The Serotonin is one of the most important mediators, contributing in the behavioral wide range, pathological and physiological processes (10), The role of serotonin transmission in the regulation of wakefulness and sleep has been studied, Early studies suggested that serotonin is necessary to obtain and maintain behavioral sleep (permissive role on sleep) (11).

The neurotransmitter dopamine plays a central role in motivation, feeding, memory and sleep–wake regulation, which is synthesized in the brain and kidneys. in the brain, the function of dopamine is a neurotransmitter and nerve cells transfer signals. The brain includes several distinct dopamine pathways; one of them plays a major role in the motivational component of reward-motivated behavior (12, 13).

Current study aims to investigate the sleep duration and mood state in alcoholism and it's affected by dopamine and serotonin levels.

Methodology

A case control study was conducting to estimate the sleep disorder and it's related with serotonin and dopamine level in alcoholism, about 41 of alcoholism cases were enrolled in present study and 30 healthy individuals as control group, blood samples and data were collected from each contributes with ethical approval. The dopamine and serotonin were measured using ELISA kits. The statistical analysis was implemented using SPSS (v23). Independent t test, correlation coefficients and ANOVA one way used for significant detection at p less than 0.05, results were represented as mean±SE and percentages.

Results and discussion

Alcoholism in Iraqi population become the most social and economic problem regarding to the health disorders and criminal troubles, the current finding shows significant reduction in age (p 0.05), sleep duration (p 0.000), serotonin (p 0.005) and dopamine (p 0.000) and significant elevation of BMI (P 0.01) in alcoholism than control group (table 1). The neurotransmitters level alteration by alcohol consume were reported, included the dopaminergic, serotoninergic, γ-amino butyric acid (GABA) and glutamate pathways (14), Volkow et al., (15) found that the withdrawal of alcohol causes reduced in dopamine function in addiction that may contribute to withdrawal symptoms and alcohol relapse. The association of alcohol uptake, impulsivity and alcohol-drinking behavior and depletion in serotonin level has been found (16).

Table (1) the mean differences of study subjects in alcoholism and control group (mean±SE, * significant differences at p lees than 0.05).

Subjects	Case	Control	sig
Age (year)	30.59±1.41	27.00±0.81	0.05*
BMI(kg/m3)	26.91±0.53	24.66±0.68	0.010*
Sleep duration (hours)	5.34±0.113	6.03±0.11	0.000*
Dopamine (ηg/ml)	4.42±1.90	8.70±1.21	0.000*
Serotonin (ηg/ml)	119.72±89.78	169.80±36.88	0.005*

Some studies reported that the ethanol stimulated dopamine releasing in a dose-response fashion (17-20), present results found decreased in dopamine level and this clarified by Yim and others (21) documented the process of DA release in the brain induced by alcohol, And this didn't respond to ethanol in a linear fashion with increasing dose, the DA level returned to baseline within 90 minutes while the ethanol level was still elevated, the dopamine elevation by the of synaptic terminal promotion for dopamine release in addition to the DA transporters inhibition(22) or by indirectly elevate dopamine levels by affecting GABAergic neurons and opioid receptors in the nucleus accumbens (23, 24)

Serotonin in alcoholism also reduced and this may be because some mechanisms like reduction in the serotonin levels in brain that release less serotonin into the synapse, or take more serotonin back up into the cells.

However the levels of serotonin metabolite in alcoholism could be lowered , because less serotonin is broken down in the brain (25).

The study groups were classified according to sleep duration to two groups less than 5 hours that high percentage in alcoholism (63.41%) than control group (16.66%), and more than 5 hours which lower in alcoholism (16.66%) than control group (83.33%). Studies found that the low amount of alcohol promotes sleep because of causes relaxation but large amount inhibit sleeping (26, 27), Stein and Friedmann (28) found that there was other problems associated with alcohol and sleep disorder like affective disorders, depression and psychological disorders.

Another classification was according to mood state to three categories bad, moderate and good mood, all control group was has good mood (100%), while alcoholism has high percentage of bad mood (63.41%), low percentage of moderate mood (12.19%) and good mood in the (21.95%) figure (1).

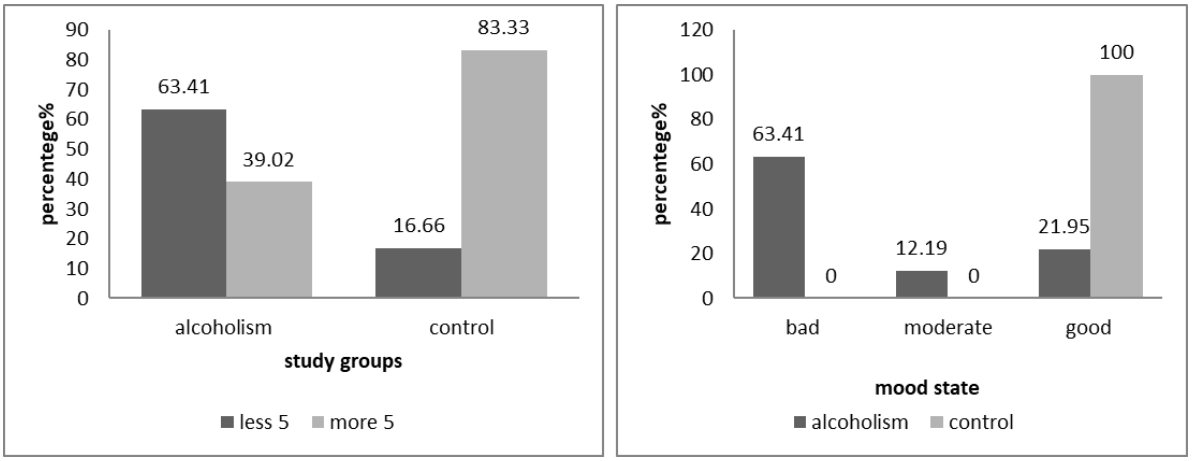

figure (1) the study group classification according to sleep duration (less than 5 hours and more than 5 hours) and mood state (bad, moderate and good).

The mood state in alcoholism show high percent of bad mood, Cooper and others (29) proposed that in regular alcohol consumers there were variation in alcohol consumption co-vary with changes in emotional states. However, there was differences among alcohol abuse individuals of their mood association with alcohol consumption, one study didn't find correlations of mood and drinking in the significantly than zero between-subject levels, but found variation according to gender (30).

The two of neurotransmitter were measured in alcoholism including serotonin and dopamine, the dopamin level shows in less than 5 categoriy non-sig differences decresed in alcoholism (p 0.555), while significant incresed in control group (p 0.035). the serotonin level shows in less than 5 hours category non-sig decresed in the alcoholism (p 0.647), and non-sig elevation in control group (p 0.525) (figure 2).

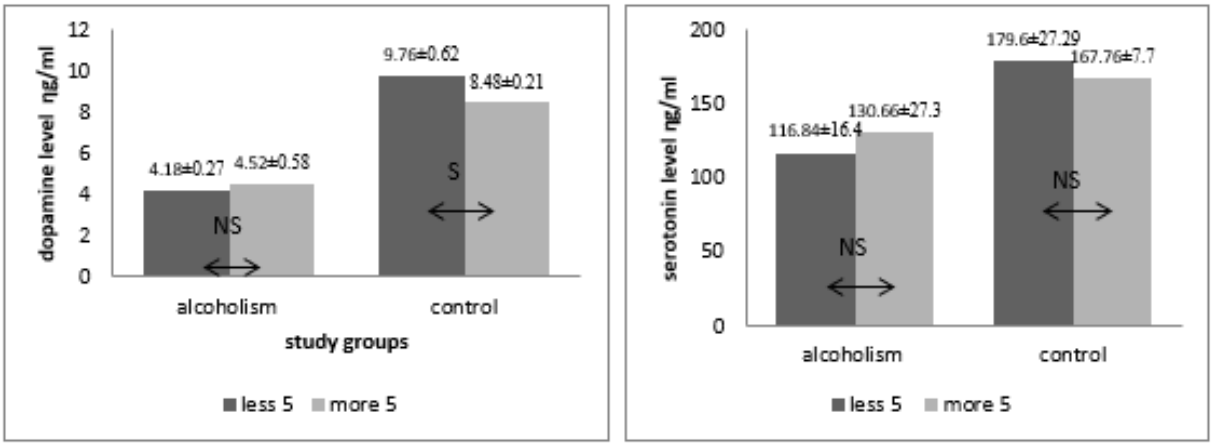

Figure (2) the dopamine and serotonin level in the study group according to sleep duration (less than 5 hours and more than 5 hours)(independent t test).

The association of serotonin and sleep cycle was various, some study indicated the association with the initiation and maintenance of sleep, and later studies indicate that serotonergic neurons also play a role in inhibiting sleep (32, 33) . The decreased in sleep duration in alcoholism may be because the effect of alcohol in the serotonin and dopamine levels, several alteration in neurotransmitter concentrations are observed in the brain progresses during the sleep–wake cycle which coordinated by complex interactions that systematically changes the firing rate of orexinergic (33), cholinergic (34), histaminergic (35), noradrenergic (36), and serotonergic (37) neurons. The dopamine and serotonin level according to mood state show significant differences (p 0.000) in dopamine level between mood state categories in alcoholism and control which in good mood, but no significant differences among alcoholism mood state categories (figure 3).

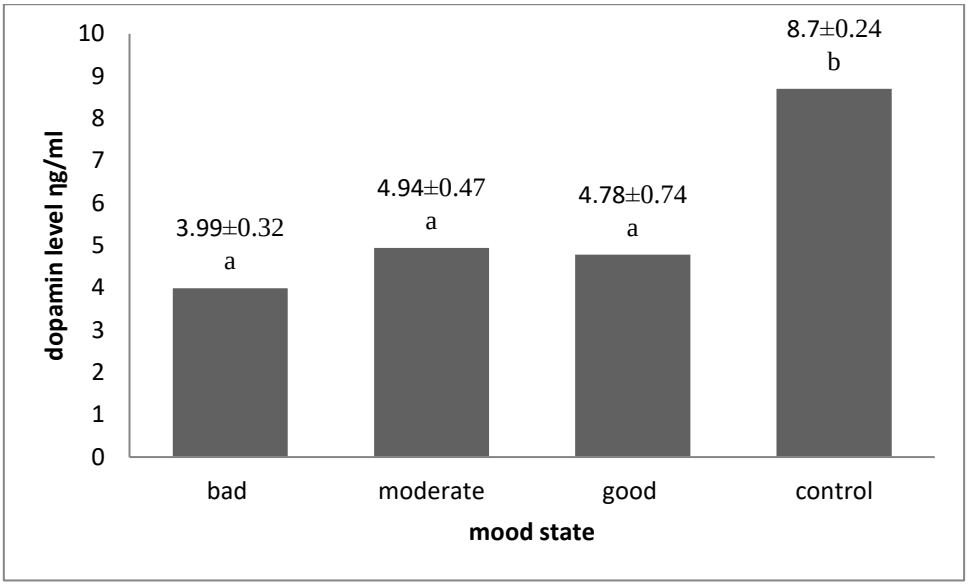

Figure (3) the dopamine level in study groups according to mood state categories in alcoholism and good mood in control group (ANOVA one way, same letters refer to non-significant differences, different letter refer to significant differences).

The serotonin level also shows significant differences among groups (p 0.005), its elevated in moderate mood of alcoholism and in good mood of control group (figure 4).

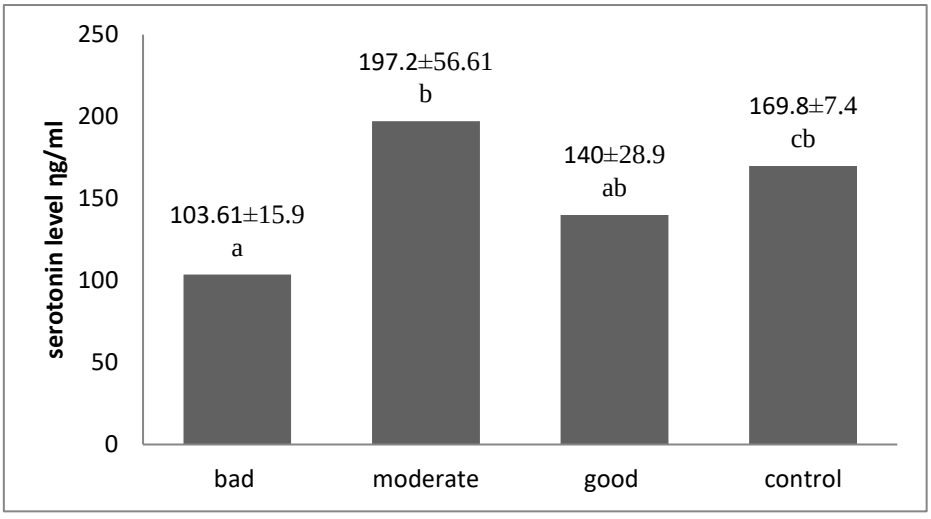

Figure (4) the serotonin level in study groups according to mood state categories in alcoholism and good mood in control group (ANOVA one way, same letters refer to non-significant differences, different letters refer to significant differences).

As a known the Dopamine is associated with happiness and serotonin regulates the mood, dopamine and serotonin activation to increase oxytocin production, When a person is physically attracted to another, the oxytocin decreased pain feeling and enhanced the emotional connection (38). Evidences found that The brain reward system is closed correlated with dopamine that enhanced enjoyment and reinforcement feeling, which stimulated an individual's to certain works. The release of DA in body trigger by rewarding experiences like sex, food, drugs, and neutral stimuli (39, 40) , in alcoholism there was unregulated lifestyle, nutrition, that lead to reduce in dopamine and serotonin. The bad mood in the alcoholism also may be affected via dopamine and serotonin receptors dysfunction that proved by several studies (41, 42).

The correlation coefficient between dopamine and sleep duration was detected, results show non-significant weak positive correlation (r 0.069, p 0.666), while in control group significant inverse correlation (r -.383, p 0.037) (figure 5)

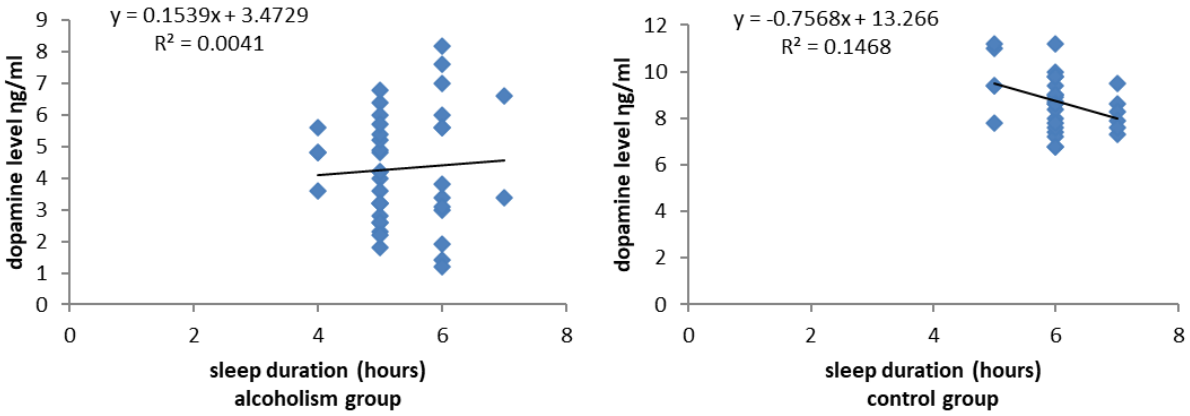

Figure (5) the correlation between sleep duration (hours) and dopamine level in alcoholism and control group.

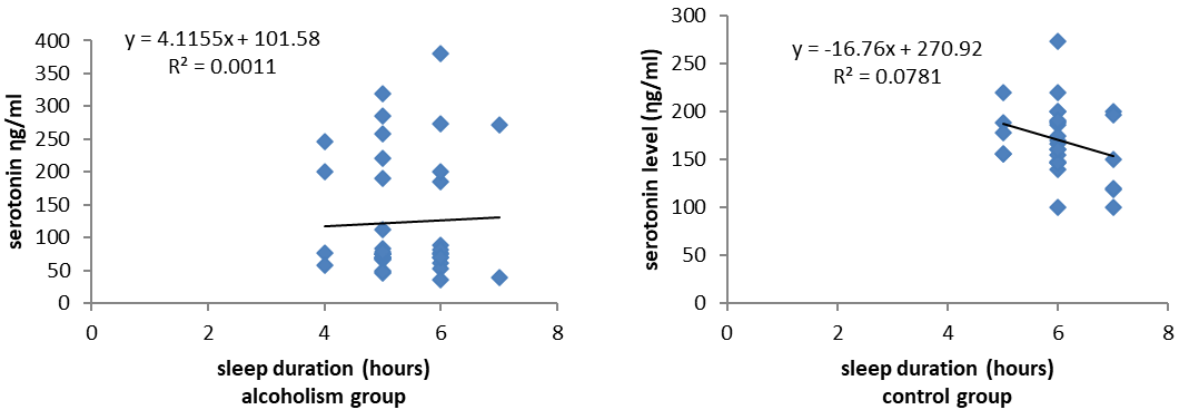

Figure (6) the correlation between sleep duration (hours) and serotonin level in alcoholism and control group.

The correlation coefficient between serotonin and sleep duration shows non-significant weak positive association (r 0.016, p 0.921) in alcoholism group, in control group non-significant inverse correlation (r -0.279, p 0.135) (figure 6).

As mention above the serotonin and dopamine were reduced in alcoholism and this effected in the mood state and sleep duration, the sleep time according to mood state shows non-significant differences in alcoholism mood state categories and significant with control group (P 0.000) (figure 7), this mean that the low sleep duration may be didn't impact in the mood state in alcoholism, whatever the chronic sleep disturbance may be affected in the mood state and cause health disorder in some reports (43-46).

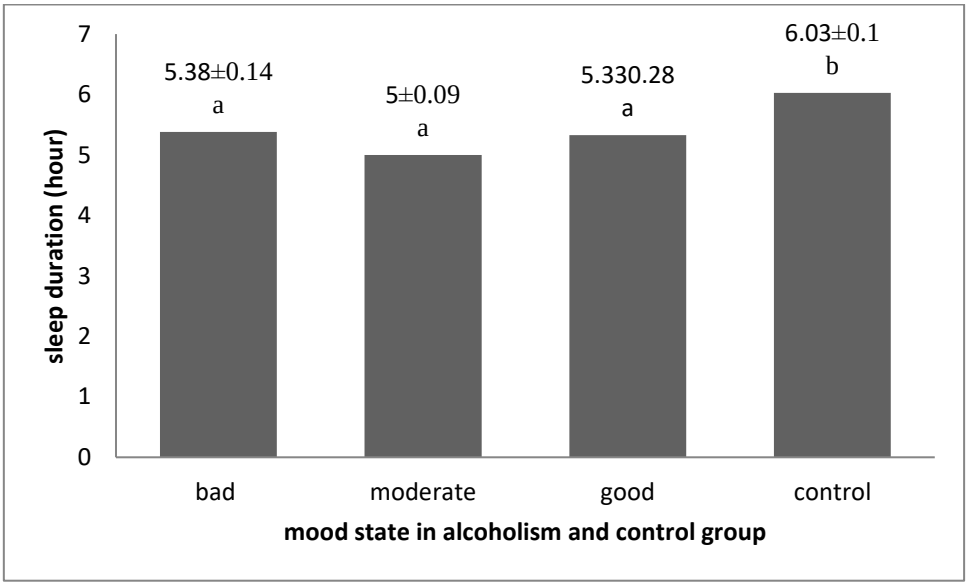

Figure (7) the sleep duration in study groups according to mood state categories in alcoholism and good mood in control group (ANOVA one way, same letters refer to non-significant differences, different letters refer to significant differences).

Conclusion

Current finding concluded that the reduction in dopamine and serotonin reduction in alcoholism may be effected in the sleep duration and mood state, this concluded need more investigation about the dopamine and serotonin receptors function, genetic polymorphisms and other neurotransmitter levels.

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