

Is There any Relationship Between Sodium and Depression?

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ÖZET:

Sodyum ve depresyon arasında bir ilişki var mıdır?

Amaç: Bazı yazarlar elektrolit dengesi bozukluklarının mizaç bozukluğuna yol açabileceğini öne sürmüştür. Az sayıda çalışmada elektrolit bozuklukları ve mizaç semptomları arasında ilişki gösterilmiştir. Bu çalışmamızda biz serum sodyum seviyeleri ve depresyon arasında herhangi bir ilişkinin olup olmadığını araştırmayı amaçladık.

Yöntem: Çalışma örneklemi psikiyatri servisinde depresif bozukluk tanısıyla yatan 42 hasta ve 34 sağlıklı kontrol grubu oluşturmuştur. Hastaların 35'i (%83.3) majör depresif bozukluk, üçü psikotik özellikli depresyon (%7.1), üçü (%7.1) katatonik özellikli depresyon ve biri de (%2.3) mevsimsel özellikli depresyon tanıları almıştı. Sabah kahvaltıdan önce serum sodyum ve kreatinin seviyeleri ölçüldü. İdrar sodyum ve kreatinin düzeyleri ve idrar dansitesi sabah ilk spot idrar örneğinde çalışıldı.

Bulgular: Depresyon hastalarında ortalama serum sodyum düzeyleri (139.51±2.00) kontrol grubuna kıyasla (140.75±2.50) anlamlı oranda düşük bulundu (p=0.040). Gruplar arasında serum kreatinin, idrar sodyum, idrar kreatinin ve idrar yoğunluk düzeyleri bakımından anlamlı fark bulunmadı.

Sonuç: Mevcut çalışma plazma sodyum seviyeleri ve depresyon arasında bir ilişki olabileceğini göstermektedir.

Anahtar sözcükler: elektrolit dengesizlikleri, mizaç bozuklukları, sodyum, depresyon

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ABSTRACT:

Is there any relationship between sodium and depression?

Objective: Some authors have suggested that abnormalities in electrolyte metabolism can cause mood disorders. A few studies have demonstrated relationships between the metabolism of electrolytes and affective symptoms. In this study, we aimed to investigate whether there is any relationship between serum sodium levels and depression.

Methods: The study sample consisted of 42 patients with depressive disorders who were consecutively admitted to the inpatient psychiatric service and 34 healthy control subjects. In the patients group, thirty-five patients (83.3%) had major depression, three (7.1%) had psychotic depression, three (7.1%) had catatonic depression and one (2.3%) had seasonal depression. The serum sodium and serum creatinine levels were measured in a blood sample before eating anything in the morning. Urine sodium, urine creatinine and density of urine were studied in the first morning spot urine sample.

Results: Patients with depression had significantly lower serum sodium than healthy control subjects (p=0.04). No significant differences between the groups in terms of plasma creatinine, urine sodium, urine creatinine and density of urine.

Conclusions: The present study suggest that there might be a relationship between serum sodium levels and depression.

Key words: electrolyte imbalances, affective disorders, sodium, depression

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INTRODUCTION

Some authors have suggested that abnormalities in electrolyte metabolism can cause mood disorders. A few studies have demonstrated relationships between the metabolism of electrolytes and affective symptoms (1-4). Gibbons (1963) reported that in some cases, affective fluctuations are related to changes of sodium and water

metabolism (2). Ozdemir et al. reported a mania like symptoms in a patient with Bartter syndrome, which is characterized by renal salt wasting (4). They argued that electrolyte imbalance could play a role in the etiology of mental disorders. Metabolic balance technique usually failed to show such variation in patients who have had only a single depressive attack, but various studies with radio sodium indicate that there may be some alteration in sodium

metabolism. Gibbons also stated that the effects of alterations in diet and activity alone couldn't explain changes in water and electrolyte metabolism. Shaw (1966) found that residual sodium (cellular plus a small amount of bone sodium) was increased in major depression and was even more abnormal in mania and sodium levels returned to normal after recovery (3). Ozdemir (2013) presented indirect evidences, which suggest a close association between sodium and depression (1). These studies also have reported that changes in electrolytes in depressive patients are not the result of vegetative symptoms of depression. In this study, we aimed to investigate whether there is any relationship between sodium and depression.

PATIENTS AND METHODS

The study sample comprised of 42 patients with depressive disorders who were consecutively admitted to the inpatient psychiatric service, between November 2012 and December 2013, and 34 healthy age and sex matched control subjects recruited from hospital staff. The university ethics committee approved the present study. The diagnosis was made using the Structured Clinical Interview for DSM-IV Axis I Disorder (SCID-IV). The severity of depression measured with the Hamilton Depression Rating Scale (HDRS) and concomitantly Hamilton Anxiety Rating Scale (HARS) were performed. All patients underwent detailed clinical evaluation including neurological examination in order to exclude primary medical conditions. Patients diagnosed with other psychiatric disorders except major

depression or general medical conditions were excluded. The serum sodium and serum creatinine levels were measured in a blood sample before eating anything in the morning. Urine sodium, urine creatinine and density of urine were studied in the first morning spot urine sample.

Statistical Analysis

Descriptive statistics for continuous variables (characteristics) were presented as mean, standard deviation, minimum and maximum values. Student t test was used to compare patients and control groups' means for the studied variables. Chi-square test was carried out to examine relationships between groups and categorical variables. Relationship between the HDRS, HARS and serum sodium were assessed by utilizing the Pearson Moment-Products Correlation Coefficients. Statistical significance levels were considered as 5%. The SPSS (ver. 13) statistical program was used for all statistical analyses.

RESULTS

In the patients group, thirty-five patients (83.3%) had major depression, three (7.1%) had depression with psychotic features, three (7.1%) had depression with catatonic features and one (2.3%) had depression with seasonal features. The mean age, gender, the mean HDRS and HARS scores are presented in Table 1. There were no significant differences between the groups in terms of mean age and gender ($p=0.756$ and $p=0.963$ respectively). The

Table 1: The mean age, gender, HDRS and HARS scores of groups

	Patients (n=42)	Controls (n=34)	
Gender Male/Female	19(45.2%)/23(54.8%)	15(44.1%)/19 (55.9%)	$P=0.963, Z=0.01$
Mean age	33.3±13.5	34.3±13.0	$p=0.756, t=0.312$
HDRS	24.0±5.6	1.4±1.3	$p=0.001, t=-19.351$
HARS	17.6±6.6	2.2±1.3	$p=0.001, t=-11.251$

HDRS: Hamilton Depression Rating Scale, HARS: Hamilton Anxiety Rating Scale

Table 2: The comparison of plasma sodium, plasma creatinine, urine sodium, urine creatinine and density of urine between patient and control groups

	Patients (n=42)	Controls (n=34)	
Serum sodium	139.51±2.00	140.75±2.50	$p=0.040, t=2.097$
Serum creatinine	0.77±0.20	0.73±0.12	$p=0.383, t=-0.878$
Urine sodium	162.03±54.38	137.90±54.37	$p=0.107, t=-1.639$
Urine creatinine	135.26±76.28	146.45±90.58	$p=0.614, t=0.507$
Density of Urine	1016.5±5.85	1018.0±5.62	$p=0.262, t=1.137$

Table 3: Pearson correlation between HDRS, HARS and serum sodium levels in patient group

	HDRS	HARS	Serum sodium
HDRS	1		
HARS	0.333*	1	
Serum sodium	0.081	.299	1

*p<0.05

mean age of patients was 33.3±13.5 years and that of controls was 34.3 years (SD=13.0). The mean HDRS and HARS scores of the patients were 24.0±5.6 and 17.6±6.6, respectively (p=0.001). The comparison of serum sodium, serum creatinine, urine sodium, urine creatinine levels and density of urine between patient and control groups are presented in Table 2. Patients with depression had significantly lower serum sodium levels than healthy control subjects (p=0.04). No significant differences between the groups in terms of plasma creatinine (p=0.383), urine sodium (p=0.107), urine creatinine levels (p=0.614) and density of urine (p=0.262). There was no correlation between serum sodium levels and HDRS or HARS in patient group (Table 3).

DISCUSSION

In this study, we hypothesized that depression is associated with abnormal sodium levels. We found that hospitalized depressed patients had lower serum sodium concentrations compared to healthy controls. There were also no significant differences between two groups with respect to plasma creatinine, urine sodium, urine creatinine levels and density of urine. These results support our hypothesis. It is well known that neurochemical changes including thyroid diseases, folate and vitamin B12 deficiency, sodium-potassium imbalance can cause variety of emotional and mental symptoms (4).

In animal studies, sodium depletion leads physiological (such as autonomic and endocrine) and behavioral changes that related to elevated salt intake. In laboratory experiments,

sodium (or salt) appetite is a behavioral drive to seek and ingest sodium containing substances which are generally hypertonic saline (NaCl) solutions that are normally avoided in the sodium replete state. This indicates that aversive motivation is converted to pleasurable or rewarding behaviors in the brain (5). The release of dopamine (DA) from mesencephalic neurons originating in the substantia nigra (SN) ventral tegmental area (VTA), and nucleus accumbens (NAc) plays an important role in reward related behaviors such as feeding and drug abuse and in the pathogenesis of depression (6,7). The preclinical and clinical studies support the role for diminished dopaminergic neurotransmission in depression (8). In vivo microdialysis studies in the NAc, the authors found that sodium-deficient rats show marked increase extracellular levels of dopamine after taking hypertonic saline solutions (5). DA receptor antagonists block increased drinking of hypertonic saline in sodium-depleted rats and also reduce mood and motivation in animal models of depression (5,6). These findings are consistent with our result which is serum sodium levels in patients are significantly lower than those in healthy controls.

It is well known that antidepressant drugs can cause hyponatremia (serum sodium 135 <mEq/L) due to the syndrome of inappropriate antidiuretic hormone secretion (SIADH) (1). Therefore, considering the possible side effect of antidepressants is an important factor in the analysis, presentation and interpretation of the findings and recommendations. This syndrome consists of faulty urine dilution in the presence of plasma hypoosmolality. The urine sodium level is also elevated in SIADH (9). In our study, there were no significant differences between the groups in terms of urine sodium and density of urine.

In conclusion, to date, there is no evidence for a direct relationship between serum sodium levels and depression, but indirect evidence (1) and the present study may suggest that low serum sodium levels and depression might be closely associated with each other. These results warrant further studies to better understanding of the issue.

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