



Serum Cholesterol, Triglyceride, and Ghrelin Levels in Criminal and Non-criminal Schizophrenia Patients

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ÖZET:

Suç işlemiş ve işlememiş şizofrenili hastalarda serum kolesterol, trigliserit ve ghrelin düzeyleri

Amaç: Suç kavramı, şahsın yaşadığı toplumdaki mevcut hukuk düzenini bozan, toplumun ahlaki kurallarını ihlal eden ve kamunun menfaatine karşı olan davranışları içeren bir kavramdır. Psikiyatrik hastalıklar içerisinde saldırgan davranışlarla ilişkili hastalık olarak şizofreni dikkat çekmektedir. Şizofrenili hastalarda suç işleme ve saldırgan davranışlar üzerinde bazı biyokimyasal parametre düzeylerinin etkili olduğu düşünülmektedir. Bu çalışmada suç işlemiş ve işlememiş şizofrenili hastalarda serum kolesterol, trigliserit ve ghrelin düzeylerindeki farklılıklar karşılaştırılarak suç üzerindeki etkilerinin değerlendirilmesi amaçlanmıştır.

Yöntem: Çalışma süresince Elazığ Ruh ve Sinir Hastalıkları Hastanesinde şizofreni tanısı almış ve tedavi gören en az bir suç kaydı olan 50 erkek şizofrenili hasta ile herhangi bir suç kaydı olmayan 50 erkek şizofrenili hasta araştırmaya alındı. Hastalara sosyodemografik bilgi formu uygulandı. Kan örnekleri, çalışma kriterlerine uyan hasta ve kontrol gruplarından sabah 08.00–11.00 saatleri arasında alınarak serum total kolesterol, trigliserit ve ghrelin düzeylerine bakıldı.

Bulgular: Suç işlemiş şizofrenili hastalar ile suç işlememiş şizofrenili hastalar karşılaştırıldığında; suç işleyen şizofrenili hastaların serum trigliserit ve ghrelin düzeyleri, suç işlememiş şizofrenili hasta grubuna göre daha yüksek bulundu. Aradaki fark trigliserit ve ghrelinde istatistiksel olarak anlamlıydı. Serum total kolesterol düzeyleri ise suç işlemiş olan şizofrenili hastalarda daha düşük olarak tespit edildi. Aralarındaki bu farklılık istatistiksel olarak anlamlı bulunmadı.

Tartışma: Bulgularımız şizofrenili hastalarda suça yatkınlık konusunda bazı biyokimyasal parametrelerin düzeylerinin önemli olduğunu gösterdi. Suç işlemede bu parametrelerin etkinliğinin güvenilir bir şekilde kullanılabilmesi için daha ileri çalışmalara ihtiyaç vardır. Özellikle kolesterol ve ghrelin düzeylerinin belirlenmesinin suç işleme eğilimi olan şizofreni hastalarının tedavi ve değerlendirmelerinde klinisyenlere katkı sağlayacağını düşünmekteyiz.

Anahtar sözcükler: Şizofreni, kolesterol, trigliserit, ghrelin, suç eğilimi

Klinik Psikofarmakoloji Bülteni 2009;19:353-358

ABSTRACT:

Serum cholesterol, triglyceride, and ghrelin levels in criminal and non-criminal schizophrenia patients

Objective: Crime is described as actions that disturb the legal order in the community, violate the ethical codes of the society or hinder public interest. Among all psychiatric diseases, schizophrenia is recognized for its association with aggressive behaviors. Some biochemical parameters are considered to induce crime and aggressive behaviors in schizophrenia patients. In this study, we aimed to compare the levels of serum cholesterol, triglyceride, and ghrelin of schizophrenia patients who have committed and not committed a crime and to analyze their effects on commitment of a crime.

Method: The current study included 50 schizophrenia patients with at least one record of crime and 50 schizophrenia patients without a crime record that were all diagnosed and treated in Elazığ Mental Hospital. All patients completed a sociodemographic information form. Blood samples for total cholesterol, triglyceride, and ghrelin levels were obtained between 08.00 AM and 11.00 AM.

Results: Serum triglyceride and ghrelin levels were higher in the schizophrenia patients that have committed a crime compared to schizophrenia patients that have not committed a crime. Difference between triglyceride and ghrelin levels was statistically significant. Levels of serum total cholesterol were lower in the schizophrenia patients that have committed a crime; however the difference was not statistically significant.

Discussion: Our findings have suggested that some biochemical parameters may be important for crime tendency in schizophrenia patients. Further studies are required to confirm the reliability of these parameters for committing a crime. We believe that cholesterol and ghrelin levels will help clinicians for better management of crime tendency in these patients.

Key words: schizophrenia, cholesterol, triglyceride, ghrelin, crime tendency

Bulletin of Clinical Psychopharmacology 2009;19:353-358

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Kabul tarihi / Date of acceptance:
17 Ağustos 2009 / August 17, 2009

Bağıntı beyanı:
A.T., M.T., M.A., M.N., B.U.: yok

Declaration of interest:
A.T., M.T., M.A., M.N., B.U.: none

INTRODUCTION

Schizophrenia is a psychiatric disorder in which the patient is drawn into his or her own introverted world through alienation to his or her usual perceptions and interpretations (1). Various factors such as genetic

predisposition, functional disturbances of neurotransmitter systems, environmental and stress factors and familial interactions have been proposed in the etiology of schizophrenia. Crime is defined as actions that disturb the legal order in the community, violate the ethical codes of the society and hinder the public interest.

Laboratory examinations on schizophrenia patients have determined that certain biochemical parameters may show some differences. Studies suggested that these differences were associated with aggressive behaviors and tendency for crime; and low levels of serum cholesterol could induce aggressive behaviors (2). Among all psychiatric diseases, schizophrenia is recognized for its association with aggressive behaviors. Studies have reported that the rate of violent behaviors in schizophrenia may be six times higher than the average of population (1).

Cholesterol is found in high amounts within the cellular membrane and membranes of the organelles (3). Low level of serum cholesterol has been reported to impair the central actions of serotonin through its effect on cellular membrane and cause resistance to schizophrenia treatment (4). Ghrelin has a regulatory role on the release of growth hormone and energy homeostasis. It is a peptide hormone produced in the gastrointestinal system that plays role in the eating behavior and regulation of body weight through its central effects (5).

Despite the presence of this background information, to our knowledge, there was no published study that compared the serum cholesterol, triglyceride, and ghrelin levels in patients with schizophrenia who have committed and not committed a crime; therefore we aimed the compare these parameters and evaluate their effect on presence or absence of crime in these patients.

MATERIALS AND METHOD

The current study included 50 male patients with at least one record of crime and 50 male patients without a crime record who were diagnosed as schizophrenia according to DSM-IV (Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition) and treated in Elazığ Mental Hospital. Blood samples for total cholesterol, triglyceride, and ghrelin were collected between 08.00 AM and 11.00 AM from all subjects in the study group and the control group that met the inclusion criteria. Patients who had significant medical or endocrine disease or a history of cholesterol-lowering medication or morbid obesity were excluded from the study.

Biochemical examinations were performed in the Biochemistry and Clinical Biochemistry Laboratory of Firat University Hospital. Blood samples drawn for

biochemical analysis were collected in routine tubes and their serum were separated by centrifugation at 3000 rpm for 5 minutes. Samples were then transferred to Eppendorf tubes and stored at -20°C until the day of analysis. At the date of analysis, samples were thawed and serum total cholesterol and triglyceride levels were measured by Olympus Biochemical Autoanalyzer (Olympus AU 2700 Autoanalyzer, Olympus Corporation, JAPAN) by spectrophotometric method using Olympus brand kits. Serum ghrelin levels were measured by ELX 800 Universal Microplate Reader (BIO-TEK INSTRUMENTS, INC, USA) using ghrelin (human) EIA kits (ELISA, Phoenix Pharmaceuticals Inc, California, USA).

All participants were informed about the design and the purpose of the study and their signed consents were obtained. The study was approved by the Hospital's Ethics Committee. Diagnostic interviews were performed for all subjects by using SCID-P and a sociodemographic data forms were also completed.

Statistical analyses were performed with student-t tests by using SPSS for Windows.

RESULTS

Mean age of the crime group was 36.52 ± 8.48 years (youngest 19, oldest 59), whereas mean age of the control group was 35.36 ± 7.74 years (youngest 21, oldest 58). Mean age for the onset of schizophrenia was 27.88 ± 7.61 years for the crime group and 24.88 ± 7.06 years for the control group. Mean height was 168.64 ± 5.34 cm, and mean weight was 68.32 ± 8.86 kg in the crime group, whereas mean height and mean weight of the control group was 169.64 ± 5.22 cm and 68.36 ± 8.34 kg respectively. No significant differences were found between the groups.

When their sociodemographic characteristics were reviewed, most of them were single males graduated from primary school, with low economic level, and usually unemployed; they rarely used alcohol but smoked frequently and they were known to suffer from multiple episodes (Table 1).

Duration of disease in the criminal group of schizophrenia patients was relatively shorter (5-10 years, 44.0%), whereas it was longer in the non-criminal group (10-20 years, 44.0%) (Table 2).

Table 1: Sociodemographic characteristics of criminal and non-criminal schizophrenia patients

	Criminal	Non-criminal
Marital Status		
Single	28	29
Married	16	17
Divorced	6	4
Educational Status		
Illiterate	12	9
Primary	23	30
High School	14	11
College	1	-
Employment		
Unemployed	34	34
Irregularly employed	14	16
Regularly employed	1	-
Retired-Student	1	-
Economical Status		
No income	44	40
Less than 500 YTL	5	10
500-1000 YTL	1	-
Alcohol Use		
Yes	5	4
No	45	46
Smoking		
Yes	44	46
No	6	4
Number of schizophrenia episodes		
0-1 episode	3	7
More than 1 episode	47	43
Residence		
Village	19	13
County	10	15
City center	21	22
Suicidal history		
Yes	11	6
No	39	44

Residual type schizophrenia was more common in non-criminal patients (78.0%) whereas undifferentiated type schizophrenia was more common among the criminal patients (62.0%) (Table 3).

Homicide was the most common crime (42%) in the criminal schizophrenia patients. It was followed by wounding (18.0%), damage to public property (14.0%), simple assault and battery (12.0%), robbery (10.0%) and being a member of illegal organization (4.0%) (Figure 1). As can be seen, violence was rather common component of the crimes.

As can be seen in Table 4, serum triglyceride and ghrelin levels of criminal schizophrenia patients were higher compared to non-criminal schizophrenia patients. Difference between the serum triglyceride ($P<0.001$) and ghrelin ($P<0.001$) levels of criminal and non-criminal schizophrenia patients was statistically significant (Figure 2). Serum total cholesterol levels of criminal schizophrenia patients were lower compared to those of non-criminal schizophrenia patients. Difference between



Figure 1: Distribution of crime types for criminal schizophrenia patients

Table 2: Duration of disease in criminal and non-criminal schizophrenia patients

	Paranoid		Catatonic		Residual		Disorganized		Undifferentiated		Total	
	n	%*	n	%*	n	%*	n	%*	n	%*	n	%**
Non-criminal	7	14.0	-	-	39	78.0	4	8.0	-	-	50	50.0
Criminal	13	26.0	-	-	6	12.0	-	-	31	62.0	50	50.0
Total	20	20.0	-	-	45	45.0	4	4.0	31	31.0	100	100.0

*: Line percentage
 **: Column percentage

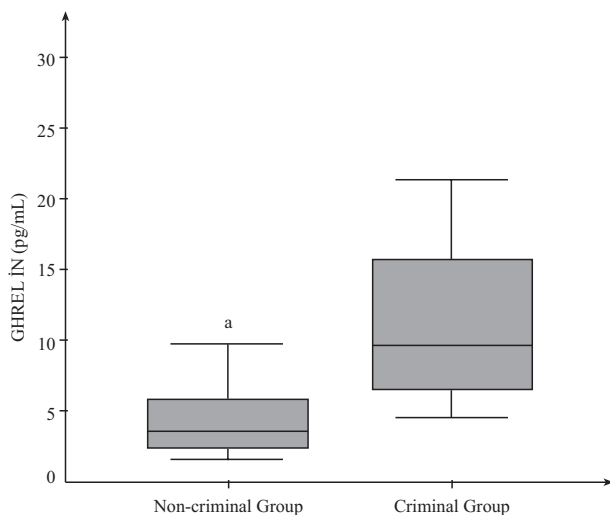
Table 3: Subtypes of schizophrenia in criminal and non-criminal patients

	0-5 years		5-10 years		10-20 years		20 years and over		Total	
	N	%*	n	%*	n	%*	n	%	n	%**
Non-criminal	4	8.0	10	20.0	22	44.0	14	28.0	50	50.0
Criminal	18	36.0	22	44.0	8	16.0	2	4.0	50	50.0
Total	22	22.0	32	32.0	30	30.0	16	16.0	100	100.0

*: Line percentage
 **: Column percentage

Table 4: Total cholesterol, triglyceride and ghrelin levels in the criminal and non-criminal schizophrenia patients

	GROUP 1 Schizophrenia (Non-criminal) (n=50)	GROUP 2 Schizophrenia (Criminal) (n=50)	P
Total Cholesterol (mg/dL)	176,14±40,02 ^a	171,46±30,56 ^a	a-group -2 P>0.05
Triglyceride (mg/dL)	122,34±33,70 ^a	153,40±38,09 ^a	a-group -2 P<0.001
Ghrelin (pg/mL)	4,45±2,45 ^a	11,51±5,45 ^a	a-group -2 P<0.001

**Figure 2: Serum ghrelin levels in the criminal and non-criminal schizophrenia patients**

a: p<0.001 Group 1 – Group 2 (Difference between the criminal and non-criminal schizophrenia patients)

the serum cholesterol levels ($P>0.05$) of criminal and non-criminal schizophrenia patients was not statistically significant.

DISCUSSION

Numerous studies on schizophrenia patients have demonstrated their tendency to crime and aggressive behaviors. Erkıran et al have determined aggressive behaviors in 56 of 105 (53.3%) schizophrenia patients (6). In several other studies the rate of aggressive behaviors ranges from 9% to 45% (7). This figure is progressively increasing in the recent years (8).

Correlation between the blood cholesterol levels and aggressive behaviors in schizophrenia patients have been previously reported (9-11). Decrease in serum cholesterol levels is considered to reduce plasma serotonin which in turn induces aggressive behaviors (2). Another study has shown that schizophrenia patients that have committed physical violence have lower serum cholesterol levels

compared to schizophrenia patients that have not committed physical violence. But the difference was not statistically significant as serum cholesterol levels did not show considerable difference (12). Similarly, in our study, serum cholesterol levels of schizophrenia patients that have committed a crime were lower compared to schizophrenia patients that have not committed a crime. This difference was not statistically significant either.

Aggressive behaviors are known to be a result of impaired function of serotonin in the brain (13). There is free exchange between the cholesterol contents of the extracellular milieu and the synaptosomal membrane lipoprotein in brain. A decrease in plasma cholesterol level also leads to a decrease in the cholesterol of neuronal membrane, which subsequently causes reduction in the number of functional serotonin receptors. Reduced function of serotonin in brain removes the inhibition of aggressive behaviors. Presynaptic re-uptake of serotonin is sensitive to changes in membrane fluidity (6, 14). Decrease of plasma cholesterol impairs the function of serotonin by interfering both at presynaptic and postsynaptic levels (6).

Study of Erkıran et al. on schizophrenia patients that have not used any medication has shown that total cholesterol levels in patients who commit aggressive behaviors were significantly lower than the patients without aggressive behaviors and healthy controls. But no correlation was found for serum triglyceride levels (6). Several similar studies have also reported that serum cholesterol levels in patients with aggressive behaviors are significantly lower, but no association was found for serum triglyceride levels (15). In another study, serum triglyceride levels were found to be significantly higher among schizophrenia patients (16). Consistent with this study, our schizophrenia patients who are under antipsychotic treatment have also shown significantly higher levels of triglyceride in patients who have committed a crime.

A study on schizophrenia patients who were treated by

antipsychotic drugs for 3 weeks has shown that serum total cholesterol and triglyceride levels of the responders were increased after the treatment (17). Another study has shown significantly higher levels of serum cholesterol in schizophrenia patients compared to control group. This finding can be explained first by the assumption that treatment of schizophrenia patients with antipsychotic drugs would increase cholesterol levels, and alternatively, negative symptoms of schizophrenia would be correlated with the duration of the disease and such negative symptoms would restrict the activities of patients which in turn result in increased levels of cholesterol (18).

Although numerous studies have demonstrated the association of low levels serum cholesterol with aggressive and violent behaviors, no studies suggests a direct association between these variables. In these studies, no correlations were established between violent behaviors and serum cholesterol levels of schizophrenia patients. In other words, the hypothesis that low levels of serum cholesterol might lead to aggressive behaviors could not be supported (12,19).

In our study, we have observed lower levels of serum cholesterol in schizophrenia patients who have committed a crime compared to schizophrenia patients who have not committed a crime, however the difference was not statistically significant ($P>0,05$). Serum triglyceride levels were also higher in the offender group. Difference of serum triglyceride levels between the groups was statistically significant ($P<0,001$) (Table 4).

Another laboratory finding that we consider being effective on crime and aggressive behaviors of schizophrenia patients is the serum levels of ghrelin. Ghrelin is a recently defined peptide hormone which is an endogenous ligand for growth hormone secretagogues. Ghrelin is secreted by the gastric mucosa. Other than stimulation of growth hormone secretion, it induces the synthesis of many hormones such as ACTH, glucagon, cortisol, aldosterone, and epinephrine. It has a role in the

regulation of eating behavior.

A study on patients who were treated in a psychiatry clinic has shown significantly higher serum ghrelin levels compared to control group (20). In the same study, no difference was observed between the serum ghrelin levels of patients with and without any disorder of carbohydrate metabolism. Several other studies on patients receiving olanzapine or risperidone did not demonstrate any change in the serum ghrelin levels (21). Another study has shown a significant increase of serum ghrelin levels of schizophrenia patients treated by olanzapine (22).

Atmaca et al. (23) have studied the patients that have attempted suicide. In their study, serum ghrelin levels were significantly higher in the schizophrenia patients who have attempted suicide; as a result they have suggested an association between these parameters (23). In our study, we have also determined that schizophrenia patients who have committed a crime had higher levels of serum ghrelin compared to schizophrenia patients who have not committed a crime (Table 4). This difference was statistically significant ($P<0.001$) (Figure 2).

Major limitations of our study may be listed as patients are still using medication and we had no control over the diet of the patients that might possibly affect cholesterol, triglyceride, and ghrelin levels. However, all subjects were hospitalized and received the same diet; which may eliminate this limitation for our study.

In conclusion; our findings show that biochemical parameters of schizophrenia patients who have committed a crime may show some differences compared to schizophrenia patients who are non-criminals. These biochemical parameters were observed to have effect on the crime itself and raised the severity of the crime, i.e., violence. Further studies are required to confirm the reliability of these parameters in committing a crime. We believe that cholesterol and ghrelin levels will help clinicians for better management of crime tendency in these patients.

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