Original Research Article

Study of serum lipid profile: An observation between criminality and psychosis in relation to aggression

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Abstract

Background & aim: Aggressive and violent behavior is being increasingly viewed as a public health problem and violence prevention has become one of the most pressing issues facing our society today. Our aim was to find correlation between lipid profile, criminal behavior and psychosis. **Method:** The present study involved 120 participants consisted of four groups. Each group consisted of 30 subjects. This study was done in two different places. One is at Circle jail Choudwar, Cuttack and second place is at in-patient Department of Psychiatry MHI, S.C.B medical college, Cuttack. First study group was male convicted prisoners selected at Circle Iail Choudwar having no psychiatric illness .The control group for this was selected from general population. The second study group was male psychotic patients having criminal record. The control group for this was selected from same ward, of male psychotic patient having no criminal record. The objective was to study the serum lipid profile of each group and it's relationship in criminality, psychosis and aggression. All the subjects in first study group and its controls were screened with General Health Questionnaire (GHQ-12).All the subjects in second study group and its controls were assessed with Overt Aggression Scale (OAS) for scoring of aggression and Brief Psychiatry Rating Scale (BPRS). **Results:** The criminal group without psychiatric illness showed significantly lower cholesterol (p=0.010) than general population and also lower than the psychotic in-patients without history of crime. The psychotic in-patient group with criminal records showed significantly lower cholesterol (p=0.001) than psychotic patients of no criminal record and also lower than non-psychotic criminal offenders. The psychotic criminal offenders showed lowest mean cholesterol than all other three groups. **Conclusion:** Our study proves a causal connection between low cholesterol and behavioral problem arising out of criminality, psychotic aggression.

Key words: cholesterol, behavioral problem, criminality, psychotic, aggression.

Introduction

In most of the studies, violence was defined as the number of violent incidents that had occurred over aspecific period of time, ranging from 1 week 39 to the entire life span.Violence was described as physical aggression against others but included threatening behaviors, a score of 2 or higher on the Overt Aggression Scale and 3 points on the Modified Overt Aggression Scale[1]. Violent behavior is defined as overt and intentional physically aggressive behavior against another person. Examples include beating, kicking, choking, pushing, grabbing, throwing objects,using a weapon, threatening to use a weapon, and forcing sex.The definition does not include aggression against self.Violent crimes include murder, robbery, assault, and rape[2]. Violent behavior is heterogeneous; that is, impulsive and premeditated violent acts differ in their origins, mechanisms, and management. Recent molecular genetic studies of neurotransmitter regulation are providing new insights into patho-physiology of violent behavior.).Serotonin synthesis and activity regulation are under genetic control. Catabolism of catecholamine occurred by enzymes monoamine oxidase (MAO) and catechol-O-methyl transferase (COMT). Genes for both types are located at the X chromosome. Low MAO activity was found in the platelets of violent offenders. Males had a point mutation in the MAO-A structural gene Male "knockout"(genetically altered) mice lacking the MAO-A gene showed aggressive behavior.

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Thus, low levels of MAO activity were associated with impulsive aggression male (but not female) knockout mice deficient in the COMT gene exhibited aggressive behavior[3]. Hence, high noradrenergic activity and low activity of the enzymes are associated with aggressive behavior.The roles of dopaminergic mechanisms have not yet provided a generally accepted pattern of association with violence.Social and cultural rearing environment has a powerful effect on behavior, including violence[4]. A more recent SPECT study in impulsive violent offenders and an auto-radiographic studies of suicide victims postmortem brain tissue confirmed, lower 5-HTT binding than that in healthy control subjects in the ventral prefrontal cortex.Reduced plasma cholesterol concentrations could depress the cholesterol/phospholipids ratio in neuronal membranes and subsequently alterations in membrane fluidity, viscosity, and function.It is also possible that dietary cholesterol may have altered the CNS availability of the serotonin precursor tryptophan[5]. Lipids including cholesterol are critical components of the cell membrane. Cholesterol depletion leads to decrease serotonin (5-HT) binding and signaling via (5-HT7) receptors in stably transfected HeLa cells.Research suggests that carriage of the low-activity S allele is associated with extremely violent criminal behavior in Chinese males[6]. Thus, our research was conducted with a focus upon the bio-psychosocial model of violence with special reference to cholesterol.

Aim & objectives

1. To compare the serum lipid profile of men with a violent criminal record having no history of psychiatric illness and men from general population.

2. To compare the serum lipid profile of male psychotic in patients with a history of violent crime and male psychotic inpatientwith no history of criminal record.
3. To establish the causal relationship of criminal behavior inrelation to aggression, comparing the serum lipid profile among three groups (criminal group without psychosis, psychotic in-patient with a history of violent crime, psychotic-in-patient with no criminal record) with general population.

Material & methods

Study Approval

Study Approval was obtained from the Institutional Ethics Committee (IEC) of SCB Medical College and Hospital, Cuttack, Odisha, India.Written informed consent was obtained from all the participants of all study as well as control groups. Study Place: The study was undertaken at Circle Jail of Choudwar, Cuttack and Department of Psychiatry, Mental Health Institute S.C.B. Medical College, Cuttack, Odisha, India.

Study Duration

The study was undertaken during the period between 30thNovember 2006 to 30"‘ November 2007.

Study Population

The study groups consisted of convicted male prisoners at Circle jail, Choudwar and Psychiatry in-patients with criminal record of Mental Health Institute, Department of psychiatry, SCB Medical College, Cuttack. The control group for convicted prisoners was chosen from general population. The control group for psychotic in-patient with criminal record were chosen psychotic in-patient with no criminal record from Mental Heath Institute Department of psychiatry. First study group (1st Study Group) selected randomly from convicted male prisoners (n=30) included murder, rape, arson and grievous injury and serving a sentence of imprisonment as per criminal code of Indian law. The men were identified from the records of Circle jail, Choudwar and random numbers were used for initial selection. If an individual refused to participate in the study or exclusion criteria were met, the person next on the list to him was invited to participate untilthe sample was complete.

First Control Group (1st Control Group)

Participants for first control group (N=3O) were selected randomly from general population. This was established by applying GHQ-12 and with same age, weight, BMI with the study grouphaving no criminal record and no health related problems. Second Study Group (2nd Study Group): Second study group (n=3O) were selected from maleInpatient department of psychiatry of MHI.

Second Control Group (2nd Control Group)

Participants of 2ndcontrol group (n=30) for second studygroup were selected randomly from Inpatient of department of psychiatry consisted of similar age, weight and BMI with no criminal record.

Table 1: Study Population – Inclusion and Exclusion criteria.

Study Population	Inclusion Criteria	Exclusion Criteria
1st Study Group (n=30)	Male convicted prisoners Age between 18-60 years More than two violent Crime as per CPC Sentence for imprisonment	No history of psychiatric illness.(Established by applying GHQ-12) No history of substance abused or dependence No history of clinical evidence of organic illness. No history of coronary heart disease No history of intake of lipid lowering drugs.
1st Control Group (n=30)		No history of major physical illness No criminal record No history of substance used
2nd Study Group (n=30)	Male psychotic in-patients Age group between 18-60 years Fulfill DSM-IV diagnostic criteria History of criminal record, known retrospectively Diagnosis confirmed by two consultant at MHI Committed crime during present psychotic episode. Taking with or without psychotropic medication.	No history of organic mental illness No history substance abused or dependence No history of coronary heart disease No history of intake of lipid lowering drugs
2nd Control Group (n=30)	Male psychotic patients of same physical parameters. No history of criminal record	

Instruments and Inventories used

1. The GHQ-12 developed Goldbery & Hillier, 1979 is a screening instrument consisting of 12 questions rated with the Lykert or modified lykert system of scoring.
2. Overt Aggression Scale (OAS) developed by Stuart Yudofsky for screening of aggression >2 score were included.
3. Brief Psychiatric Rating Scale (BPRS), Lukoff Nuecterlein and ventura, 1986 was applied to all the participants in the inpatient dept.
4. A format containing socio-demographic profiles of general population.
5. Fasting venous plasma blood sample for estimation of lipid Profile

Statistical Analysis

Unpaired t-test was done comparing the biochemical parameters within the two study groups. Pearsons correlation co-eficients were calculated forbiochemical parameters and the scores of psychopathology on theexpanded BPRS scale. Subsequently, serum lipid profile in relation topsychopathology, criminality and aggression was statistically analyzed.

Results

Table 2: Comparison of mean cholesterol between All four groups

Types of Group	Mean Cholesterol
General population	179.90
Psychotic inpatients with no H/o Crime	174.73
Convicted Criminal Group	155.73
Psychotic Inpatient group with h/o crime	147.37

Psychotic in-patinet group with H/o Crime showed lowest mean cholesterol than all other groups.

Table 3: Comparison of lipid profile between all four groups

Types of Group	Mean Cholesterol	HDL	TG	LDL	VLDL
General population	179.90	33.80	168.07	112.49	33.61
Psychotic inpatients Group with no H/o Crime	174.73	32.13	122.20	118.16	24.44
Convicted Criminal Group	155.73	32.57	138.60	95.45	27.72
Psychotic Inpatient groups with h/o crime	147.37	34.67	110.93	90.51	22.19

All the parameters of serum lipid profile showed lower in psychotic in-patient group with history of crime among all four groups.

Table 4: Comparison of mean cholesterol between convicted Criminal with general population

Different Groups	Mean Cholesterol	P-value
Convicted Criminal	155.73	0.010
General Population	179.90	

This table depicted significant lower mean cholesterol in convicted criminal group than general population with p-value of 0.010.

Table 5: Comparison of mean cholesterol between psychotic inpatients with H/O crime and psychotic in patients with no h/o crime

Different groups	Mean Cholesterol	P-Value
Psychotic Inpatient Group with H/o Crime	147.37	0.001
Psychotic inpatients with no H/o Crime	174.73	

This table depicted lower mean cholesterol in psychotic patient having criminal record then non-criminal psychotic group with a p-value of 0.001 which is significant.

Discussion

The objectives of present study were study of serum lipid profile of criminal groups, psychotic patients with criminal record and psychotic patient without criminal record in order to explore their relationships with criminality and aggression. Finally, to explore therelationships with various physical parameters as well as socio- demographic profile. The mean biochemical values between the two groups showed in Table No.-02 to Table No.-05. Unpaired t-test was done comparing the biochemical values between two groups. On the basis of physical parameters the two groups did not vary significantly in age, weight and body mass index. The mean cholesterol value of convicted prisoners was 155.73 comparing with the mean cholesterol value of 179.90 in control group. Standard deviation was 29.62 and 40.10 of both groups respectively. The convicted male prisoners showed significantlylower total cholesterol (p=0.010), lower LDL cholesterol (p=0.039)compared with the men from general population. Similar findings were reported by Virkkunen et al[7] who studied serum lipid profile and apo lipoprotein A1 and B of 30 men withcriminal behavior. However, HDL, VLDL and Triglyceride level betweentwo groups did not vary significantly .p=0.082, p='-0.249, p=0.249respectively.With regard to cholesterol, the findings in this study aresimilar to those in previous studies, which suggested a link betweenlower cholesterol and criminality to others (Virkkunen et al[8],Kaplan et al[9], Muldon et al[10],Golomb et al[11], Repo-Tiihonen et al.[12], Chakrabarti et al[13]). They are consistent with our findings and with expectation of lower serum cholesterol in violent criminal offenders. The psychotic group with a history of violent crime showedsignificantly lower total cholesterol (p=0.001), lower LDL cholesterol(p=0.000) compared to the psychotic group without a history of violentcrime. Similar findings were reported by Edgar et al[14] who studied serum lipid profile and apo-lipoproteinA1 and B of 30 male psychotic patient with violent criminal record. The LDL cholesterol is one of the main forms of transportof cholesterol from the liver to extra-hepatic tissues, while HDLcholesterol is the main form of transport of cholesterol from extra-hepatic tissues to liver. The entire body of findings in the criminal group of thisstudy suggests a metabolism, which favors the removal of cholesterolfrom the extra hepatic tissues. In the central nervous system, this willled to reduced cell membrane viscosity and reduced receptor exposure. This includes the serotonergic receptors and hence may lead to reducedcentral serotonergic activity. Further it has been seen that membrane cholesterolmodulates the functional properties of the SERT by specific molecular interactions (Lester et al)[15]. Western blot analysis concluded that cholesterol depletion decreases 5-HT7 receptors activity(Siever et al)[16]. This was the hypothesis first proposed by Huang et al[17] and later published by Verma et al[18] to explain the roleof lowered cholesterol in aggression, via reduced central serotonergicactivity. Some later studies have also tried to prove the cholesterol-serotonin hypothesis (Diaz et al., Lalovic et al)[19,20].

Conclusion

Our study has shown the association of Low Cholesterol level with degree of violence/aggression. Severe irritability may occur in some statin users. Lowerplasma EPA levels combined with low concentrations were associatedwith self-harm as well as impulsivity and affect. Lower totalcholesterol, lower LDL cholesterol, higher apolipoprotein A1 and lowerapolipoprotein B could predispose to violence.Abnormal cholesterol levels have been reported in schizophrenia.Currently, coronary heart disease is one of theleading cause of death and a significant part of the world populationpredicted to take statin drugs in near future to reduce their cholesterol. It is time to think seriouslywhether we are doing justice with them. Just like our weight, there isan optimum level of cholesterol as well. However, clinicians should keep these possible adverse effects in mind when prescribing statinagents. Nothing could be further from the truth. If our cholesterolis too low, we will have an increased risk of mood disorders, depression,stroke, and violence and these are only the known ejects right now. Hence, extensive research is further needed to establish a balanced relationship between serum cholesterol level and violence/aggression.

References

1. Frick MH, Elo O, Haapa K, et al: Helsinki Heart Study: primary prevention trials with gemfibrozil in middle-aged men with dyslipidemia. New England Journal of Medicine 1987 ;317:1237-1245.
2. Lipid Research Clinics Program: The lipid research clinics coronary primary prevention trials results: I. reduction in the incidence of coronary heart disease. JAMA 1984;252:351-364.
3. Muldon MF, Manuck SB, Matthew KM: Lowering cholesterol concentrations and mortality: a quantitative review of primary prevention trials. British Medical Journal 1990;301:309-314.
4. Santiago JM, Dalen JE: Cholesterol and violent behavior. Archives of Internal Medicine 154:1317-1321, 1994
5. Kaplan JR, Manuck SB, Shively C . The effects of fat and cholesterol on social behavior in monkeys. Psychosom Med 1991; 53: 634–642.
6. Ryman A: Cholesterol, violent death, and mental disorder. British Medical Journal 1994;309:421-422.
7. Virkkunen M: Serum cholesterol in antisocial personality. Neuropsychobiology 1979;5:27- 30.

8. Virkkunen M, Pentinnen H: Cholesterol in aggressive conduct disorder: a preliminary study. Biological Psychiatry 1984; 19:435-439.
9. Kaplan JR, Muldoon MF, Manuck SB, Mann JJ. Assessing the observed relationship between low cholesterol and violence-related mortality. Implications for suicide risk. Ann N Y Acad Sci. 1997 Dec 29;836:57-80.
10. Muldoon MF, Ryan CM, Sereika SM, Flory JD, Manuck SB. Randomized trial of the effects of simvastatin on cognitive functioning in hypercholesterolemic adults. Am J Med. 2004 Dec 1;117(11):823.
11. Golomb BA, Stattin H, Mednick S. Low cholesterol and violent crime. J Psychiatr Res. 2000 Jul-Oct;34(4-5):301-9.
12. Repo-Tiihonen E, Halonen P, Tiihonen J, et al. Total serum cholesterol level, violent criminal offences, suicidal behavior, mortality, and the appearance of conduct disorder in Finnish male criminal offenders with antisocial personality disorder. Eur Arch Psychiatry Clin Neurosci. 2002 Feb;252(1):8–11.
13. Chakrabarti N, Sinha VK. A study of serum lipid profile and serum apolipoproteins A1 and B in Indian male violent criminal offenders. Crim Behav Ment Health. 2006;16(3):177-82.
14. Edgar PF, Hooper AJ, Poa NR, et al. Violent behavior associated with hypocholesterolemia due to a novel APOB gene mutation. Mol Psychiatry. 2007 Mar;12(3):258–263.
15. Lester D. Serum cholesterol levels and suicide: a meta-analysis. Suicide Life Threat Behav. 2002;32(3):333–346.
16. Siever LJ. Neurobiology of aggression and violence. Am J Psychiatry. 2008 Apr;165(4):429-42.
17. Huang TL, Chen JF. Cholesterol and lipids in depression: Stress, hypothalamo-pituitary-adrenocortical axis, and inflammation /immunity Adv Clin Chem. 2005;39:81–105.
18. Verma S, Trivedi JK, Singh H, Dalal PK, Asthana OP, Srivastava JS, et al Serum lipid profile in suicide attempters Indian J Psychiatry. 1999;41:300–6.
19. Diaz-Sastre C, Baca-Garcia E, Perez-Rodriguez MM, Garcia-Resa E, Ceverino A, Saiz-Ruiz J, et al Low plasma cholesterol levels in suicidal males: A gender- and body mass index-matched case-control study of suicide attempters and nonattempters Prog Neuropsychopharmacol Biol Psychiatry. 2007;31:901–5.
20. Lalovic A, Levy E, Luheshi G, Canetti L, Grenier E, Sequeira A, et al Cholesterol content in brains of suicide completers Int J Neuropsychopharmacol. 2007;10:159–66.

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