Prevalence and Associated Factors of Dyslipidemia Among Psychiatric Patients on Antipsychotic Treatment at Hawassa University Comprehensive Specialized Hospital

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ABSTRACT

BACKGROUND: Dyslipidemia is one of the adverse metabolic outcomes associated with psychotropic medications and the nature of the mental illness itself. Therefore, this study aimed to assess magnitude of dyslipidemia and associated factors among patients with severe mental illness on antipsychotic treatments.

METHODS: A cross-sectional study was conducted among 245 patients with severe mental illness in Hawassa University Comprehensive Specialized Hospital, Sidama Regional state, Southern Ethiopia. Socio-demographic and other important data were collected using a structured questionnaire through a systematic random sampling technique. Individual dyslipidemia was characterized by the National Cholesterol Education Program Adult Treatment Panel-III (NCEP ATP-III) guideline.

RESULTS: Mean total cholesterol (TC) was significantly higher in males when compared to females (162.2 mg/dl vs 121 mg/dl, P = .023). While, mean LDL-cholesterol was significantly higher in females when compared to males (100.9 mg/dl vs 93.6 mg/dl, P = .028). Overall 58.4% (95% CI: 52.2-64.8) of participants had at least 1 dyslipidemia. The prevalence of TC ⩾200 mg/dl, HDL-cholesterol <40 mg/dl, triglyceride (TG) and LDL-cholesterol were 61 (24.9%), 75 (30.6%), 66 (26.9%), and 47 (19.2%), respectively. Female sex and smoking were significantly and positively associated with LDL-c dyslipidemia, the aOR (95% CI) were 2.1 (1.0-4.2) for female sex and 3.4 (1.1-10.5) for smoking. Also, Age >40 years was significantly associated with TC dyslipidemia, the aOR (95% CI) was 2.0 (1.1-3.7).

CONCLUSION: More than half of psychiatric patients are at risk of developing cardiovascular and other related health problems. Therefore, periodic screening of lipid profiles during healthcare follow-up is mandatory to limit risks of cardiovascular-related comorbidities among patients with severe mental illness.

KEYWORDS: Severe mental illness, dyslipidemia, Hawassa, Southern-Ethiopia

Introduction

Conventional antipsychotics drugs that are used to treat various psychotic disorders like schizophrenia, bipolar disorder, and major depression were introduced in the 1950s. However, the need for better molecules was continued until the discovery of second-generation anti-psychotics (SGAs).

Many psychiatric disorders including schizophrenia, bipolar disorder, and major depression accompany an excess burden of cardiovascular morbidity and mortality.[1,2] In addition, many commonly used psychotropic medications particularly antipsychotics, mood stabilizers, and some antidepressants have been independently associated with cardio-metabolic risk factors such as insulin resistance, obesity, and dyslipidemia.[3] Dyslipidemia is one of the adverse metabolic outcomes associated with

psychotropic medications and anti-psychotics like Olanzapine and clozapine are well known to cause significant hyperlipidemia and hypertriglyceridemia.[4-6] Moreover, mood stabilizers are also associated with hyperlipidemia. Several studies have shown an increase in triglyceride levels in patients treated with valproate.[7] Few studies and case reports are available to support the changes in lipid synthesis and storage with antidepressant use.[3]

The pathophysiology of psychotropic induced weight gains and change in lipid profile remains unclear and it might be associated with many factors.[8] Lipid abnormalities may follow observable weight gain associated with prescribed medications, increased lipid biosynthesis through induced gene expression of specific enzymes necessary for lipid metabolism[9] or they

provoke cell-autonomous and weight-independent effects on insulin secretion by pancreatic β cells that lead to metabolically adverse adipokines profile and may directly affect central nervous system regulation of hepatic glucose production.[10-12] In addition, it is unclear whether increased caloric consumption and/or decreased energy expenditure (or both) is the basis for pharmacotherapy-induced weight gain and adiposity-related comorbidities.[10-12]

Dyslipidemia is an imbalance of an individual's lipid components, comprising elevated levels of total cholesterol (TC), low-density lipoprotein cholesterol (LDL-c), and triglycerides (TGs), or reduced level of high-density lipoprotein cholesterol (HDL-c).[13] The World Health Organization (WHO) estimates that dyslipidemia is associated with more than half of the global cause of ischemic heart diseases.[14] Men with better cholesterol levels (<200 mg/dl) had a greater life expectancy of 3.8 to 8.7 years compared to men with higher cholesterol levels. Any LDL-c level above 100 mg/dl is considered atherogenic and can increase the risk of cardiovascular disease.[15,16]

The underlying pathogenesis of antipsychotic drugs (APDs) effects on metabolism is further complicated by several characteristics of patients for whom APDs are typically prescribed. People with schizophrenia may encounter environmental factors predisposing them to metabolic disturbances including sedentary lifestyle, poor nutrition, and increased rates of smoking as compared to the general population.[17]

To the best of our knowledge, data are very scarce regarding dyslipidemia among patients with severe mental illness (SMI) in Ethiopia, mainly in the study area. Therefore, this study was carried out to assess the magnitude and associated factors of dyslipidemia among patients with SMI.

Methods

Study area, study design, and population

This hospital-based cross-sectional study was conducted among patients with SMI in Hawassa University Comprehensive Specialized Hospital (HUCSH), Hawassa city, Southern Ethiopia from January to June 2019. Hawassa is the capital city of the Southern nation's nationalities and Peoples Region (SNNPR) and distant 275 km from the capital city of Ethiopia, which is Addis Ababa. HUCSH is one of the largest health facilities found in the region, which provides teaching, training of health professionals, and public health services. All adult SMI patients with a minimum age of 18 years old having consistent follow up in the psychiatric department and who were on APDs at least for 12 months were eligible for the study. Regarding antipsychotic agents: Chlorpromazine, Fluphenazine, Haloperidol, Thioridazine, Risperidone, Olanzapine, Clozapine, and others were available in the hospital for treating patients during the study period. However, those patients on statin drugs, non-fasting, and pregnant women were not considered in the study.

Sample size estimation and sampling technique

Regarding dyslipidemia assessment, we considered the HDL-c <40 mg/dl from previously conducted study among SMI patients, which was 41.5%.[18]

$$n = \frac{(Z_{\alpha/2})^2 p (1-p)}{d^2} = \frac{(1.96)^2 * 0.415 * (1-0.415)}{(0.05)^2} = 373$$

Where, P = proportion of dyslipidemia (.415), 1-p = (1-0.415 = 0.585), $Z\alpha_{/2}$ = at 95% confidence interval (Z = 1.96) d = Marginal error (5%), n = calculated sample size, which was 373. However, sample size correction was required based on the size of psychiatric population applying with Cochran's formula. Subsequently, **249** psychiatric patients from the outpatient department having a regular follow up were eligible and enrolled in the study using systemic random sampling techniques.

Definition of terms

Dyslipidemia. It was defined according to the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) criteria of 2002,[19] and patients should have at least one of the following abnormal lipid profiles in their serum/plasma: TC ≥200 mg/dl, LDL-c ≥130 mg/dl, HDL <40 mg/dl and TGs ≥150 mg/dl.

Elevated blood pressure (BP: in millimeter of mercury (mmHg)). It is defined as systolic blood pressure (SBP) and diastolic blood pressure (DBP) ≥120/80 mmHg; whereas **hypertension** is defined as SBP and DBP ≥130/80 mmHg (according to Prevention, detection, evaluation, and management of high blood pressure in adults: synopsis of the 2017 American College of Cardiology/American Heart Association Hypertension Guideline.[20]

Body mass index. BMI classified according to the expert panel on the identification evaluation and treatment of overweight and obesity in adults, 1998: that classified as BMI <18.5 Kg/m² for underweight, BMI 18.5 to 24.9 Kg/m² for normal weight, BMI 25 to 29.9 kg/m² for overweight, and BMI ≥30 kg/m² for obesity.

Severe mental illness. The diseases comprise those disorders, which cause psychotic symptoms, such as schizophrenia, schizoaffective illness, and severe forms of other disorders, like major depression and bipolar disorders. Besides, the illnesses that cause alterations of perception, delusions, hallucinations, and unusual behaviors are sometimes called thought disorders.[21]

Data collection procedures and assessments

Initially, the purpose and benefits of the study was transparently clarified to each participant, and the written informed

consent was obtained from each study subject before rushing to data collection. In addition, patients were well informed regarding the rights of study refusal at any point in the procedure. Then data on socio-demographic, and other relevant information was collected using pre-tested and interviewer-administered structured questionnaires by trained nurses who were working in the psychiatry department. Trained nurses did the measurements of waist circumference (WC), body weight, height, and blood pressure for each of the study participants using standardized types of measuring equipments in accordance with the WHO stepwise technique.[22]

Blood sample collection and lipid profiles analysis

About 4 to 5 milliliters of overnight fasting venous blood was collected from each participant using a gel-based serum separator tube (SST), kept a minimum of 20 to 30 minutes at 20°C for proper clot formation. Then the samples were centrifuged at 2500 to 3000 rpm for 8 to 10 minutes for serum separation through Gel Bridge. Trained laboratory technologists who were working in the hospital did the blood collection as well as laboratory diagnosis. Besides, the serum sample of each patient was analyzed for lipid profile (TC, HDL-c, LDL-c, and TGs) using A25 Random Access chemistry Analyzer (Spain). Enzymatic colorimetric assay method was used for the measurement of TC by cholesterol oxidase phenol 4-amino antipyrine peroxidase (CHOD-PAP) method and TGs by glycerol phosphate oxidase-p-aminophenazone (GPO-PAP) methods. In addition, the determination of HDL-c and LDL-c was done by enzymatic colorimetric method using the total cholesterol reagent after selective precipitation of lipoproteins. All the reagents used for lipid profile determination were from linear chemicals (Montgat, Spain). Moreover, all laboratory-based performances were managed in accordance with standard operating procedures (SOPs). Further instrument precision, lipid reagents, and technical performances were checked through running of commercially prepared lyophilized quality control (QC) samples.

Statistical analysis

The questionnaires were carefully checked, entered into and analyzed by Statistical Package for Social Sciences (SPSS), Version 23. Descriptive statistics like mean, standard deviation, median (interquartile range), and proportions were used. Differences and significance levels between mean values of normally distributed continuous data were assessed by Student's *t*-test while categorical data were assessed using Pearson's Chi-square and or Fisher's exact test. Logistic regression analysis also was applied to check the crude and adjusted effect of apparently significant factors. Further, only a variable with a *P*-value <.25 in the bivariate analysis was comprised into multivariate analysis and statistical significance was addressed using alpha cut-off <5%.

Results

Socio-demographic and other characteristics of the study population

Of the total 249 psychiatric patients approached, 245 were enrolled in the study. One hundred forty-three participants (58.4%) were males and 102 (41.6%) were females with the mean (± SD) age of 32 (11.2) years old. More than half, 138 (56.3%) of the psychiatric patients were aged between 20 and 34 years, while 24 (9.8%), 64 (26.1%), 19 (7.8%) were aged <20 years, 35 to 49 years and ≥50 years, respectively. The majority (72.2%) of the study subjects were aged ≤40 years, 58.4% were currently single, 40.4% were married and the rest 1.2% were divorced/widows. Regarding ethnicity, 70 (28.6%), 31 (12.7%), 51 (20.8%) and 41 (16.7%) were Sidama, Wolayita, Amhara, and Oromo, respectively.

In addition, the education level: 12 (4.9%), 93 (38%), 55 (22.4%), 85 (34.7%) of the study were unable to read and write, primary, secondary and tertiary, respectively. About 16 (6.5%), 58 (23.7%), 17 (6.9%), 28 (11.4%), 55 (22.4%), and 71 (29%) of the psychiatric patients were farmers, government or private employed, merchants, housewives, students, and non-employed, respectively.

Regarding behavioral and physical activity, 14 (5.7%) of the study participants were drinking alcohol, 18 (7.3%) were smoking cigarettes, 211 (86.1%) have sedentary lifestyle, 14 (5.7%) were performing light activities and the rest 20 (8.2%) were performing moderate physical activities.

Moreover, 117 (47.8%), 87 (35.5%), 22 (9%), 9 (3.7), 9 (3.7%), and 1 (0.4%) of psychiatric patients had schizophrenia, a major depressive disorder with psychotic features, bipolar disorders, delusional disorders, schizophrenic-form disorder, and had schizoaffective disorder types of mental illnesses.

The median (interquartile range) duration of mental illness was 3 (2-5) years, and majorities (69.4%, n = 170) were experienced less than 5 years disease duration. One hundred sixty-two (66.1%) were receiving a single type of psychotic drug, while the rest 83 (33.9%) were receiving a minimum of 2 types of drugs. The most common antipsychotic treatments used by the patients were combination type 83 (33.9%) followed by chlorpromazine tablet 56 (22.9%), Risperidone 47 (19.2%), Amitriptyline 19 (7.8%), Olanzapine 13 (5.3%), Fluoxetine 9 (3.7%), and Thioridazine 5 (2.0%). The rest 13 (5.2%) were on Sodium valproate, Haloperidol, Fluphenazine decanoate, and phenobarbitol.

The mean (± SD) BMI of the study participants was 22.9 (4.6) kg/m² and 22.45% had BMI ≥ 25 Kg/m². The mean (±SD) of serum LDL- c, TC, HDL-c, and TGs of the study participants were 93.6 (43.6), 168 (47.2), 50.2 (17.7), and 123 (58.9), respectively. In addition, the study subjects with BP ≥ 120/80 mmHg, TC ≥ 240 mg/dl, LDL-c ≥ 160 mg/dl, and TGs ≥ 200 mg/dl were 138 (56.3%), 17 (6.9%), 14 (5.7%), and 26 (10.6%), respectively (Table 1).

Table 1. Biochemical and other characteristics of patients with severe mental illness.

VARIABLES	TOTAL 245 (%)
BMI, Kg/m² mean(±SD)	22.9 (4.6)
BMI	
<18.5 Kg/m²	26 (10.6)
18.5-24.9 Kg/m²	164 (66.9)
25-29.9 Kg/m²	40 (16.3)
≥30 Kg/m²	15 (6.1)
WC, cm, mean(±SD)	81.8 (10.5)
WC: Normal	215 (87.8)
WC: High	30 (12.2)
SBP, mmHg, mean, (±SD)	120 (9.4)
SBP: <120 mmHg	191 (78.0)
SBP: ≥120 mmHg	54 (22.0)
DBP, mmHg, mean(±SD)	78.8 (6.8)
DBP: <80 mmHg	180 (73.5)
DBP: ≥80 mmHg	65 (26.5)
TC, mg/dl, mean(±SD)	168 (47.2)
TC: Desirable (<200 mg/dl)	184 (75.1)
TC: Borderline high (200-239 mg/dl)	44 (18.0)
TC: High (≥240 mg/dl)	17 (6.9)
HDL-c, mg/dl, mean(±SD)	50.2 (17.7)
Low(<40)	75 (30.6)
Borderline high (40-59)	99 (40.4)
High (≥60)	71 (29.0)
TGs, mg/dl, mean(±SD)	123 (58.9)
TGs: Normal (<150 mg/dl)	179 (73.1)
TGs: Borderline high (150-199 mg/dl)	40 (16.3)
TGs: High (≥200 mg/dl)	26 (10.6)
TC/HDL-c ratio, mean(±SD)	3.8 (1.8)
TC/HDL-c ratio: <5	195 (79.6)
TC/HDL-c ratio: ≥5	50 (20.4)
LDL-c, mg/dl, mean(±SD)	93.6 (43.6)
LDL-c: Optimal (<100 mg/dl)	142 (58.0)
LDL-c: Near optimal (100-129 mg/dl)	56 (22.9)
LDL-c: Borderline high (130-159 mg/dl)	33 (13.5)
LDL-c: High (≥160 mg/dl)	14 (5.7)
BP: <120/80 mmHg	95 (38.7)
BP: ≥120/80 mmHg	138 (56.3)

Abbreviations: BMI, body mass index; DBP, diastolic blood pressure; HDL-c, high-density lipoprotein cholesterol; SBP, systolic blood pressure; SD, standard deviation; TGs, triglycerides; WC, waist circumference.

The mean TC was significantly higher in male when compared to females (162.2 vs 121, *P* = .023). However, the mean LDL-c, and BMI were significantly higher in females when compared to males (100.9 mg/dl vs 93.6 mg/dl, *P* = .028; and 24.1 Kg/m² vs 22 Kg/m², *P* = .001), respectively. In addition, the mean TGs, HDL-c, TC/HDL-c ratio, SBP, WC, and DBP did not show any significant differences between sex (*P* > .05 for all).

The prevalence of TC ≥ 200 mg/dl, BMI ≥ 25 Kg/m², and abnormal WC (>102 cm in males and >88 cm in females) were significantly higher in females when compared to males (*P* = .048, 0.006, and <0.0001, respectively). However, the rate of BP ≥ 120/80 mmHg was significantly higher in males when compared to females (38.8% vs 22.4%, *P* = .048), respectively (Table 2). Moreover, among 47 (19.2%) of patients with LDL-c dyslipidemia, 28 (59.6%), and 13 (27.7%) of them had schizophrenia and major depressive disorder with psychotic features.

The pattern of overall dyslipidemia in relation to different variables

The overall 143 (58.4%, 95% CI: 52.2-64.8) of the study participants had a minimum of 1 lipid profile abnormal that is compatible with a diagnosis of dyslipidemia. About 55 (22.4%), 44 (18%), 23 (9.4%), 18 (7.3%), and 3 (1.2%) of psychiatric patients had single, 2, 3, 4, and all 5 types of lipid profile abnormal, respectively. The prevalence of dyslipidemia was insignificantly higher in males 82 (33.5%) when compared to females 61 (24.9%), *P* = .70. In addition, patients with BP ≥ 120/80 mmHg, patients with a sedentary lifestyle, patients using a single type of antipsychotic drugs also had an insignificantly higher rate of dyslipidemia when compared to their counterparts, the rates were 92 (37.6%) for BP ≥ 120/80 mmHg, 122 (49.8%) for the sedentary lifestyle and 87 (35.5%) for those who were on a single type of antipsychotic drugs (Table 3). Moreover, dyslipidemia in relation to antipsychotic treatment type was indicated in Table 4.

In bivariate analysis: being female, the crude odds ratio (cOR) and (95% CI) was 1.8 (1.0-3.2) for TC ≥ 200 mg/dl. Age >40 years, the cOR (95% CI) was 1.7 (0.91-3.1) for TC ≥ 200 mg/dl and 2.1 (1.2-3.9) for TG ≥ 150 mg/dl. In addition, duration >5 years since the diagnosis of SMI, the cOR (95% CI) was 2.0 (1.0-3.8) for HDL-c <40 mg/dl, 2.5 (1.3-4.8) for TG ≥ 150 mg/dl and 2.3 (1.1-4.7) for TC/HDL-c ratio. Moreover, elevated blood pressure to hypertension (≥ 120/80 mmHg), the cOR (95% CI) was 2.0 (1.1-3.7) for TG ≥ 150 mg/dl.

However, multivariate analysis was adjusted for the possible confounders. Therefore, female sex and smoking were significantly and positively associated with LDL-c ≥ 130 mg/dl, the adjusted odds ratio (aOR) and 95% CI were 2.1 (1.0-4.2) for the female sex and 3.4 (1.1-10.5) for smoking. Besides age >40 years was significantly associated with TC ≥ 200 mg/dl, the aOR (95% CI) was 2.0 (1.1-3.7) (Table 5).

Table 2. Anthropometric, cardio-metabolic, and lipid profiles of psychiatric patients by gender.

VARIABLES	TOTAL 245 (%)	MALES N = 143 (%)	FEMALE N = 102 (%)	P-VALUE
Total cholesterol, mg/dl, mean ± SD	168 (47.2)	162.2 (46.4)	121 (53.5)	.023
<200 mg/dl	184 (75.1)	114 (46.5)	70 (28.6)	
≥200 mg/dl	61 (24.9)	29 (11.8)	32 (13.1)	.048
HDL-cholesterol, mg/dl, mean ± SD	50.2 (17.7)	49 (17.3)	51.7 (18.2)	.26
<40 mg/dl	170 (69.4)	94 (38.4)	76 (31.0)	
≥40 mg/dl	75 (30.6)	49 (20.0)	26 (10.6)	.14
LDL-cholesterol, mg/dl, mean ± SD	93.6 (43.6)	88.5 (44)	100.9 (42)	.028
<130 mg/dl	198 (80.8)	121 (49.4)	77 (31.4)	
≥130 mg/dl	47 (19.2)	22 (9.0)	25 (10.2)	.074
Triglycerides, mg/dl, mean ± SD	123 (58.9)	123.2 (62.6)	122 (53.5)	.87
<150 mg/dl	179 (73.1)	104 (42.4)	75 (30.6)	
≥150 mg/dl	66 (26.9)	39 (15.9)	27 (11.0)	.89
TC/HDL-c ratio, mean ± SD	3.8 (1.8)	3.7 (1.8)	3.8 (1.8)	.73
<5	195 (79.6)	113 (46.1)	82 (33.5)	
≥5	50 (20.4)	30 (12.2)	20 (8.2)	.79
BMI, Kg/m², mean ± SD	22.9 (4.6)	22 (4.2)	24.1 (5)	.001
<25 Kg/m²	161 (65.7)	104 (42.3)	57 (23.3)	
≥25 Kg/m²	84 (34.3)	39 (15.9)	45 (18.4)	.006
WC, cm normal	215 (87.8)	141 (57.6)	74 (30.2)	
Abnormal	30 (12.2)	2 (0.8)	28 (11.4)	<.0001*
SBP, mmHg, mean (±SD)	120 (9.4)	120.4 (8.8)	119.5 (10.3)	.43
<120 mmHg	191 (78)	114 (46.5)	77 (31.4)	
≥120 mmHg	54 (22)	29 (11.8)	25 (10.2)	.43
DBP, mmHg, mean (±SD)	78.8 (6.8)	79.2 (6.3)	78.2 (7.5)	.27
<80 mmHg	180 (73.5)	107 (43.7)	73 (29.8)	
≥80 mmHg	65 (26.5)	36 (14.7)	29 (11.8)	.57
BP status <120/80 mmHg	95 (38.8)	48 (19.6)	47 (19.2)	
≥120/80 mmHg	150 (61.2)	95 (38.8)	55 (22.4)	.048

Abbreviations: BMI, body mass index; BP, blood pressure; DBP, diastolic blood pressure; HDL, high-density lipoprotein; LDL, low- density lipoprotein; SBP, systolic blood pressure; SD, standard deviation; TC, total cholesterol; WC, waist circumference.
*P-value by Fisher's exact test; [abnormal WC: >102 cm in males and >88 cm in females].

Discussion

Due to the severity of mental illness condition, and poor physical activity or sedentary lifestyle, and the side effects of antipsychotic treatments, the prevalence of lipid profile derangements is increasing, mainly in population with severe mental illness and they are at risk of developing cardiovascular

Table 3. Prevalence of dyslipidemia in relation to different variables.

VARIABLES	TOTAL	DYSLIPIDEMIA		P-VALUE
	N=245 (%)	NO, N (%)	YES, N (%)	
Sex				
Male	143 (58.4)	61 (24.9)	82 (33.5)	.70
Females	102 (41.6)	41 (16.7)	61 (24.9)	
Age				
≤40 y	177 (72.2)	78 (31.8)	99 (40.4)	.21
>40 y	68 (27.8%)	24 (9.8)	44 (18.0)	
Marital status=				
Single	143 (58.4)	65 (26.5)	78 (31.8)	.20
Married	99 (40.4)	35 (14.3)	64 (26.1)	
Divorced/Widow	3 (1.2)	2 (0.8)	1 (0.4)	
Education=Unable to read and write	12 (4.9)	7 (2.9)	5 (2.0)	.58
Primary	93 (38)	39 (15.9)	54 (22.0)	
Secondary	55 (22.4)	18 (7.3)	37 (15.1)	
Tertiary	85 (34.7)	38 (15.5)	47 (19.2)	
Occupation =				
Farmers	16 (6.5)	8 (3.3)	8 (3.3)	.167
Employed	58 (23.7)	25 (10.2)	33 (13.5)	
Merchants	17 (6.9)	7 (2.9)	10 (4.1)	
Housewife	28 (11.4)	9 (3.7)	19 (7.9)	
Students	55 (22.4)	30 (12.2)	25 (10.2)	
Non-employed	71 (29.0)	23 (9.4)	48 (19.6)	
BMI=				
<25 Kg/m^2	161 (65.7)	77 (31.4)	84 (34.3)	.006
≥25 Kg/m^2	84 (34.3)	25 (10.2)	59 (24.1)	
BP status =				
<120/80 mmHg	95 (38.8)	44 (18.0)	51 (20.8)	.24
≥120/80 mmHg	150 (61.2)	58 (23.7)	92 (37.6)	
Drinking alcohol=				
No	231 (94.3)	95 (38.8)	136 (55.5)	.51
Yes	14 (5.7)	7 (2.9)	7 (2.9)	
Smoking=				
No	227 (92.7)	96 (39.2)	131 (53.5)	.46
Yes	18 (7.3)	6 (2.4)	12 (4.9)	
Physical activity=				
Sedentary	211 (86.1)	89 (36.3)	122 (49.8)	.82

(Continued)

Table 3. (Continued)

VARIABLES	TOTAL	DYSLIPIDEMIA		P-VALUE
	N = 245 (%)	NO, N (%)	YES, N (%)	
Light	14 (5.7)	6 (2.4)	8 (3.3)	
Moderate	20 (8.2)	7 (2.9)	13 (5.3)	
Disease duration =				
1-4 y	170 (69.4)	77 (31.4)	93 (38)	.06
5-9 y	65 (26.5)	24 (9.8)	41 (16.7)	
≥10 y	10 (4.1)	1 (0.4)	9 (3.7)	
Drug combination				
Single	162 (66.1)	75 (30.6)	87 (35.5)	.039
Multiple	83 (33.9)	27 (11.0)	56 (22.9)	

Abbreviations: BMI, body mass index; BP, blood pressure.

Table 4. Pattern of dyslipidemia with the type of antipsychotic treatments.

TYPE OF TREATMENT	DYSLIPIDEMIA	
	NO, 102 (%)	PRESENT, 143 (%)
Chlorpromazine	27 (26.5)	29 (20.3)
Amitriptyline	8 (7.8)	11 (7.7)
Risperidone	21 (20.6)	26 (18.2)
Sodium valproate	1 (1.0)	3 (2.1)
Olanzapine	5 (4.9)	8 (5.6)
In combination	27 (26.5)	56 (39.2)
Haloperidol	2 (2)	2 (1.4)
Fluphenazine diaconate	2 (2)	2 (1.4)
Phenobarbitol	1 (1.0)	0 (0.0)
Fluoxetine	6 (5.9)	3 (2.1)
Thioridazine	2 (2)	3 (2.1)
Total (n = 245)	102 (41.6)	143 (58.4)

diseases (CVDs). In addition, the increase of atherogenic lipids suggest a potential risk for the emergence of CVDs at a significant rate among patients with SMI in the near future. Therefore, this cross-sectional study was conducted in resource-limited East African setting to assess the patterns of dyslipidemia among patients with SMI receiving antipsychotic treatments at least for 12 months without switching.

In this study, the overall prevalence of dyslipidemia was 58.4% (95% CI: 52.2-64.8) using NCEP ATP III criteria and the rate was almost comparable with the study reported from Seoul, South Korea that indicated 61% of schizophrenia patients had dyslipidemia.[23]

In this study, the prevalence of low HDL-c (<40 mg/dl) was 69.4%. It was inconsistent with the rate reported from different studies like 42.1% in India,[24] 48.4% in Seoul, South Korea,[23] 52% in Palestine,[25] 58.5% in Southwest Ethiopia,[19] 56% in Korea,[26] 52.5% in Durban, South Africa,[27] 42.5% among major depressive disorder patients and 25% among schizophrenic patients in Egypt,[28] 47.7% among schizophrenic and bipolar patients in Turkey,[29] 52.5% in Saudi Arabia,[30] 35.2% among schizophrenic patients in Singapore,[31] and 23% in Hong Kong.[32] However, the depicted studies used cutoff limit <40 mg/dl in males and <50 mg/dl in female to define low HDL-c; whereas <40 mg/dl was used as a cutoff limit for both sex as described in 2002 NCEP-ATP III guidelines and this might be a reason for the rate variation between the studies.

In this study, the prevalence of high-level TC was 24.9% and this is nearly comparable with the study conducted in Hong Kong,[32] which was 22%. However, it is not in line with the studies conducted in India,[24] and Singapore,[31] in which the prevalence was 36.7% and 14.8%, respectively. Types of antipsychotic drugs utilized by patients, the poor performance of physical activities/ sedentary lifestyle, and genetic variability across the population may be a reason for the described variations.

Based on TGs cut-off value (≥150 mg/dl), the prevalence of raised TGs in the present study was 26.9%. This was comparable with the prevalence rate reported from Hong Kong[32] and Southwest Ethiopia,[19] in which the prevalence was 25% and 25.3%. Conversely, the finding was higher than the prevalence reported from several studies like 17.5% in India[24] and 14.5% in Durban, South Africa.[27] Higher prevalence rate also were reported from different international studies like 46% in Korea,[26] 32.8% in Saudi Arabia,[30] 44.1% in South Korea schizophrenic patients,[23] 49.2% in Palestine,[25] 42.5% in major depressive patients and 30% in schizophrenic patients in Egypt,[28] 53.6% among schizophrenic and bipolar disorder

Table 5. Factors associated with abnormal lipid profiles among adult psychiatric patients.

EXPLANATORY VARIABLES	OUTCOME VARIABLES				
	TC ⩾ 200 MG/DL	HDL-C < 40 MG/DL	LDL-C ⩾ 130 MG/DL	TG ⩾ 150 MG/DL	TC/HDL-C ⩾ 5
BMI >25 Kg/m² (%)	24 (9.8)	31 (12.7)	19 (7.8)	27 (11.0)	21 (8.6)
cOR (95% CI)	1.3 (0.73-2.4)	1.5 (0.89-2.7)§	1.4 (0.72-2.7)	1.5 (0.8-2.6)§	1.5 (0.80-2.9)§
aOR (95% CI)	N/A	1.6 (0.9-2.9)	N/A	1.2 (0.62-2.4)	1.4 (0.72-2.7)
Gender: Female (%)	32 (13.1)	26 (10.6)	25 (10.2)	27 (11.0)	20 (8.2)
cOR (95% CI)	1.8 (1.0-3.2)§*	0.57 (0.32-1.0)	1.8 (0.94-3.4)§	0.96 (0.5-1.7)	0.92 (0.49-1.7)
aOR (95% CI)	1.6 (0.86-3.0)	1.7 (0.95-3.1)	2.1 (1.0-4.2)*	N/A	N/A
Age >40 y (%)	22 (9.0)	19 (7.8)	18 (7.3)	26 (10.6)	18 (7.3)
cOR (95% CI)	1.7 (0.91-3.1)§	0.84 (0.45-1.55)	1.8 (0.94-3.6) §	2.1 (1.2-3.9) §*	1.6 (0.84-3.2)§
aOR (95% CI)	2.0 (1.1-3.7)**	N/A	1.7 (0.83-3.3)	1.6 (0.74-3.5)	1.2 (0.55-2.5)
Education: 2ndry (%)	33 (13.5)	42 (17.1)	26 (10.6)	42 (17.1)	32 (13.1)
cOR (95% CI)	0.85 (0.47-1.5)	0.93 (0.54-1.6)	0.9 (0.48-1.7)	1.4 (0.8-2.6)§	1.4 (0.75-2.7)
aOR (95% CI)	N/A	N/A	N/A	0.87 (0.45-1.7)	N/A
Occupation: Employed (%)	15 (6.1)	16 (16.1)	10 (4.1)	18 (7.3)	10 (4.1)
cOR (95% CI)	0.93 (0.47-1.8)	1.2 (0.63-2.3)	1.2 (0.55-2.5)	0.77 (0.4-1.5)	1.3 (0.61-2.8)
aOR (95% CI)	N/A	N/A	N/A	N/A	N/A
Marital status: Married (%)	29 (11.8)	37 (15.1)	23 (9.4)	32 (13.1)	26 (10.6)
cOR (95% CI)	1.4 (0.77-2.5)	1.6 (0.91-2.7)§	1.4 (0.76-2.7)	1.5 (0.8-2.6)§	1.7 (0.91-3.2)§
aOR (95% CI)	N/A	1.5 (0.86-2.7)	N/A	1.1 (0.52-2.3)	1.5 (0.73-3.0)
Alcoholism = Yes (%)	3 (1.2)	3 (1.2)	3 (1.2)	3 (1.2)	2 (0.8)
cOR (95% CI)	0.81 (0.22-3.0)	0.60 (0.16-2.2)	1.1 (0.31-4.3)	0.73 (0.19-2.7)	0.63 (0.13-2.9)
aOR (95% CI)	N/A	N/A	N/A	N/A	N/A
Smoking: Yes (%)	7 (2.9)	70 (28.6)	6 (2.4)	6 (2.4)	4 (1.6)
cOR (95% CI)	2.0 (0.75-5.5)§	0.86 (0.29-2.5)	2.7 (0.8-6.4)§	1.4 (0.5-3.9)	1.1 (0.35-3.6)
aOR (95% CI)	2.8 (0.99-8.2)	N/A	3.4 (1.1-10.5)*	N/A	N/A
Exercise: Sedentary (%)	53 (21.6)	64 (26.1)	41 (16.7)	56 (22.9)	42 (17.1)
cOR (95% CI)	1.1 (0.46-2.5)	0.91 (0.42-2.0)	1.1 (0.44-2.9)	0.87 (0.4-1.9)	0.81 (0.34-1.9)
aOR (95% CI)	N/A	N/A	N/A	N/A	N/A
Duration: >5 y (%)	15 (6.1)	21 (8.6)	14 (5.7)	21 (8.6)	16 (6.5)
cOR(95% CI)	1.4 (0.72-2.9)	2.0 (1.0-3.8)§*	2.0 (0.96-4.1)§	2.5 (1.3-4.8)§**	2.3 (1.1-4.7) §*
aOR (95% CI)	N/A	1.7 (0.9-3.4)	2.0 (0.94-4.2)	1.2 (0.64-2.5)	2.0 (0.98-4.1)
Treatment: Combined type (%)	23 (9.4)	29 (11.8)	18 (7.3)	27 (11.0)	21 (8.6)
cOR (95% CI)	1.2 (0.68-2.3)	1.3 (0.77-2.4)	1.3 (0.66-2.4)	1.5 (0.85-2.7)§	1.5 (0.82-2.9)§
aOR (95% CI)	N/A	N/A	N/A	1.2 (0.64-2.5)	1.6 (0.82-3.0)
BP ⩾ 120/80 mmHg (%)	39 (15.9)	45 (18.4)	29 (11.8)	48 (19.6)	32 (13.1)
cOR (95% CI)	1.2 (0.64-2.1)	0.93 (0.53-1.6)	1.0 (0.53-2.0)	2.0 (1.1-3.7) §*	1.2 (0.61-2.2)
aOR (95% CI)	N/A	N/A	N/A	0.88 (0.43-1.8)	N/A

Abbreviations: aOR, adjusted odds ratio; BMI, body max index; CI, confidence interval; cOR, Crude odds ratio; HDL-c, high-density lipoprotein cholesterol; LDL-c, low-density lipoprotein cholesterol; TC, total cholesterol; TG, triglyceride.
[**Reference category:** BMI ⩽ 25 Kg/m², Males, Age ⩽ 40 y, no smoking, education ⩽ primary level; currently unmarried; no drinking alcohol; non-employed; light to moderate exercise; duration ⩽ 5 y; single treatment type].
§P < .25. *P < .05. **P < .01.

patients in Turkey,[29] and 29% in South Africa.[33] However, the degree of disturbances of lipid profile induced by different generations of antipsychotic agents, duration of antipsychotic therapy, nutritional habit, and location could show a disparity in the prevalence rate between the studies.

In this study, TC ⩾200 mg/dl was significantly higher among females when compared to males (13% vs 11.8%, $P = .048$), respectively. In similar, the study conducted in South Africa[33] reported that females have 2 times more likely to have cholesterol dyslipidemia when compared to males. In addition, the present study indicated that cholesterol dyslipidemia was significantly and positively associated with age >40 years, and the finding in line with the reports of 2 studies, which indicated a significant and positive association between older age and cholesterol dyslipidemia.[34,35]

In the present study, the mean LDL-c was significantly higher in females when compared to males (100.9 mg/dl vs 88.5 mg/dl, $P = .028$), respectively. The finding was inconsistent with the study conducted in India[24] and Hong Kong,[32] in which LDL-c dyslipidemia did not show any significant differences in gender. In this study, female sex was significantly associated with LDL-c dyslipidemia and the finding was in line with the study conducted in Hawassa, Southern-Ethiopia.[35] 59.6% of schizophrenic patients had LDL-c dyslipidemia in the present study and in similar one study revealed that a significant association between and LDL-c dyslipidemia and schizophrenic mental problem.[33]

In this study, smoking was significantly associated with LDL-c dyslipidemia. It is eminent that smoking deranges serum lipid profile and it increases TC, TG, ApoB, and LDL-c level in the blood, while it decreases HDL-c.[36,37] The linking between smoking and dyslipidemia is multifaceted, but a supposed association might be due to the stimulation of the sympathetic adrenal system by nicotine to secrete catecholamines[38] and these catecholamines may potentiate lipolysis and increases the concentration of lipids in plasma.

Limitations of the study

First, we did not include the normal population as a control group. However, we tried to compare the dyslipidemia of patients with severe mental illness previously conducted summary report on Ethiopia steps survey on risk factors for chronic non-communicable diseases (NCDs) and prevalence of selected NCDs of the Ethiopian population. This is an evidence for the increase of dyslipidemia among patients with SMI when compared to the control group.[39] In addition, our study was cross-sectional by its nature and it cannot evidence of dyslipidemia and its causative risk factors adequately. Irrespective of the described limitations, this study provides helpful information in the limited data situation of Ethiopia.

Conclusion

Overall, more than half of psychiatric patients had at least 1 dyslipidemia. Female sex and smoking were significantly and

positively associated with LDL-c dyslipidemia, while age >40 years was significantly associated with TC dyslipidemia. This indicates high proportion of psychiatric patients are at risk of evolving cardiovascular and related health problems. Therefore, repetitive screening of lipid profiles during health care plays a great role to minimize the risks of coexisting morbidity of cardiovascular diseases with severe mental illness.

Authors' Contribution
Study conception and design: ATH; acquisition of data: TT; Laboratory analysis: ATH, EW; statistical analysis and interpretation of data: ATH; drafting of the manuscript: ATH, WAG; critical revision of the manuscript: ATH.

Availability of Data Statement
The dataset of this article is at Hawassa Comprehensive Specialized Hospital but not openly available. However, it is accessible on reasonable request from the corresponding author with the authorization of Hawassa University College of Medicine and Health Science ethics committee.

Ethical Considerations
The study was approved by the institutional review board (IRB) of Hawassa University College of Medicine and Health Sciences (IRB 100 09). Go-ahead was obtained from Hawassa University Comprehensive Specialized Hospital Clinical and Academic Director office and the study was done in accordance with the code of Helsinki declaration of Ethical Principles for Medical Research Involving Human beings. In addition, the participants were well informed about the protocol of the study and written informed consent was obtained before actual data collection. Further, the confidentiality of data was strictly maintained.

Informed Consent
Written informed consent was obtained from study participants before collecting actual data

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