Chapter

Diabetes-Related Distress and Associated Factors among People with Type 2 Diabetes in Mekelle City, Tigray Region, Ethiopia

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Abstract

Severe emotional distress brought on by diabetes affects one in ten people with type 2 diabetes, one in five people with type 1 diabetes, and one in four people with type 2 diabetes who are using insulin. Therefore, the aim of this study was to determine the prevalence and factors associated with diabetes distress among T2D patients in Tigray region, Ethiopia, An institution-based cross-sectional study was employed on type 2 diabetes patients attending in two hospitals of Tigray. Systematic random sampling technique was used to select the participants. Data were collected using interviewer-administered questionnaire package with PAID Scale. An unpaired t-test was used for continuous variables to compare two groups and binary logistic regression analysis model was used to identify the determinants of diabetes distress. Forty-nine (30.6%) patients showed high diabetes distress. The major predictors were education level [AOR = 5.9; 95% CI: 1.29–27.11, P = 0.022)], Physical activity [AOR = 0.395; 95% CI: 0.16–0.95), P = 0.040] and type of health facility [AOR = 3.2; 95% CI = (1.26, 8.20), P = 0.014]. In conclusion, high diabetes distress was prevalent among T2D patients and lower education level, being physically inactive and attending general hospital contributing as risk factors for high diabetes-related distress.

Keywords: diabetes, distress, type 2, Mekelle City, depression and prevalence

1. Introduction

Diabetes mellitus is a metabolic disorder characterized by hyperglycemia [1]. Type 1 diabetes (T1D) or type 2 diabetes (T2D) are the two broad categories of diabetes, with T2D being the most common [2]. The number of people with diabetes is increasing due to population growth, aging, urbanization, and increasing prevalence of obesity and physical inactivity [3]. Diabetes prevalence in 2021 was globally 10.5% (537 million people). In Africa 4.5% (24 million), and in Ethiopia 4.7% (3 million) [4]. Diabetes is a complex illness that is regarded as being difficult to manage because it involves many restrictive recommendations and the emotional discomfort that diabetic patients experience is an area of developing clinical interest [5].

Mental illness is a prevalent disease among diabetes patients, particularly those with type 2 diabetes [6]. The mental illness common among diabetic patients are depression, anxiety, eating disorders, cognitive dysfunction/ dementia, diabetes-related distress, refusal to initiate insulin therapy, and persistent fear of hypoglycemia [7]. Risk of type 2 diabetes development could be increased by the interplay of biological and psychological factors that contribute to depression [8]. Several evidences suggest diabetes and depression are closely related; diabetic patients are twice more likely to suffer from depression than nondiabetics patients. Depression, however, hinders daily self-management and increases the chance of acquiring diabetes [2].

Depression is a common and serious medical illness that negatively affects how someone feels and the way think and act [9]. Diabetic patients with type 1 and type 2 could have a depression prevalence of three times greater and twice as high, respectively, than the general population globally [10]. Depression can be categorized as a first, recurrent, or chronic episode; it can also range in severity from mild to severe, with or without psychotic symptoms [11].

Major depressive disorders are characterized by prolonged sadness, lack of interest in or enjoyment in activities that the person usually enjoys, and hopelessness coupled with an inability to do everyday tasks for at least 2 weeks [12]. In diabetic patients, the presence of depression and anxiety worsens the prognosis for diabetes and raises noncompliance with medical treatment [13], lowers the standard of living [14], and raise mortality [15]. Similarly, depression has been strongly linked to macrovascular complications such as retinopathy, nephropathy, neuropathy, and sexual dysfunction [16].

The symptoms of diabetes-related distress overlap with several well-known mental health problems, such as depression [17, 18]. Although there are some similarities among diabetes distress and depression, they have different definitions and need for different methods of assessment and treatment. Diabetes distress, in contrast to depression, does not imply psychopathology; it is a normal response to diabetes, whereas depression refers to how people feel about their lives generally [19]. Moreover, diabetes distress is a construct proposed by researchers to describe the emotional response to living with diabetes that requires chronic and demanding self-management. Diabetes distress captures a person's experience with the problems associated with diabetes [20]. Diabetes distress is more common than depression in people with diabetes, despite the fact that depression is more common in this population and may have higher effects on the disease's course [21].

Diabetes distress is an emotional response to living with diabetes, the stress of managing it, and its long-term effects [17–19]. Diabetes distress may also result from the social effects of diabetes (e.g., stigma, discrimination, or others' unhelpful reactions or lack of understanding) [5, 22] and the financial implications of the condition [17, 23]. Diabetes distress can also reach peak at times of heightened general stress, when burden of diabetes self-care becomes too much [24]. Severe emotional discomfort is connected to diabetes and affects one in four patients with type 1 diabetes, one in five patients with type 2 diabetes who are taking insulin, and one in ten patients with type 2 diabetes who are not taking insulin [25]. In one study diabetes distress (DD) was reported by 41% of the participants, and in another study DD was reported by 44.6% of participants [26, 27].

There are significant clinical consequences to untreated emotional distress in diabetes. If left untreated, mild diabetes distress often persists [28] and may develop into severe diabetes-related distress and/or depression [29]. Studies found that diabetes-related distress, but not depression, was significantly related to poorer glycemic control [18, 21]. or through dysregulation of stress hormones [30]. A meta-analysis result

showed that diabetic patients with severe diabetes distress or depression of any severity are less likely to engage in appropriate self-care behaviors and participate in quality care such as annual eye exams and immunizations [31]. Diabetes distress also leads to increased diabetes-related complications and impaired quality of life, affecting physical function, social function, and overall health [32].

Worrying about the future and the potential for serious complications and experiencing feelings of guilt and anxiety when diabetes management goes off track are the most frequently reported problem areas by people with type 1 and type 2 diabetes [33, 34]. Diabetes distress can vary depending on the type of diabetes, even though there are common stressors for all types of diabetes (e.g., type 1 diabetes is more frequently related to insulin treatment and hyper/hypoglycemia; type 2 diabetes is more frequently related to social consequences, food restriction, and obesity) [35]. The management of HbA1c, blood pressure, cholesterol, and overall health can be improved by early detection, routine screening, and the use of evidence-based treatment modalities for depression and diabetes distress. This reduces medical expenses [36].

Many studies have assessed the prevalence of DRD using the DD-17 scale among people with T2DM, but almost all were conducted in developed countries and not in sub-Saharan countries. Additionally, the presence of DRD depends on the characteristics of the study population and other psychosocial factors [37]. Moreover, to the best of our knowledge, there have been no studies conducted in Ethiopia using the PAID scale. Therefore, the purpose of this study was to determine the prevalence and associated factors of diabetes distress among type 2 diabetic patients in Mekelle City, Tigray Region, Northern Ethiopia.

2. Methods

2.1 Study design, setting, and period

A cross-sectional study design was used to conduct a study at the Ayder Comprehensive Specialized Hospital (ACSH) Endocrinology and Diabetes Clinic and Mekelle General Hospital (MGH) Referral Clinic, Mekelle City, Tigray Region, Northern Ethiopia. In 2019, the region reached overall primary healthcare coverage of 96% with a total of 712 health posts, 204 health centers, 20 primary hospitals, 2 specialized referral hospitals and 15 public general hospitals, and there were around 500 health facilities operating in the private sector [38]. These hospitals provide basic health services and manage patients with different diseases including diabetic mellitus. About 3000 patients with diabetes received health services at these general hospitals in 2019. The actual data collection period was from August to December 2021.

2.2 Population

The source population was all adult type 2 diabetic (T2D) patients attending at the diabetes/ referral clinics of public hospitals found in Mekelle City of Tigray, while the study population was all sampled adult T2D patients who were under routine follow-up at Ayder comprehensive specialized and Mekelle general hospitals during the data collection period.

2.3 Sample size and sampling technique

The required sample size (n) was estimated using a STATCALC for population survey via Epi-Info version 7 Software with assumption of a CI of 0.95, a relative precision of 0.05, and the expected proportion of distress among diabetic patients in Vietnam was 12.5% [39]. This provides a sample size of 165; however, a refusal rate was predicted to be 5%, and then the final sample size was 173. The hospitals (ACSH &MGH) were selected purposively, and an equal amount of sample size was allocated. A systematic random sampling procedure was employed to select the participants.

2.4 Eligibility criteria

All T2D patients who were 18 years of age or older, present during the study period and had recent laboratory results were included in the study. Patients with type 1 diabetes (T1D) and those who had untreated hypothyroidism, gestational diabetes, cancer, mental retardation, and psychiatric illness, patients who were severely ill and unwilling to participate, were excluded from the study.

2.5 Variables

Dependent variable was diabetes related distress (DRD) and independent variables ware socio-demographic information (i.e. age, sex, marital status, educational level, occupation, and living arrangement), clinical characteristics (i.e. diabetes treatment, duration of diabetes, FBS and BP), and behavioral factor (confidence in self-management; healthy diet, vegetable consumption, diabetic medication adherence, glucose measured per week, smoking, alcohol consumption and physical exercise).

2.6 Operational definitions

Hypertension is defined as systolic blood pressure (SBP) $\geq$ 140 mmHg and/or diastolic blood pressure (DBP) $\geq$ 90 mmHg [40]. Following a healthy diet means consuming vegetables, fruits; whole grains, protein, low-fat dairy and its products and low simple carbohydrates, fat/oil, avoiding alcohol [41]; high-fat/oil consumption means eating or consuming more than 10% of calories from saturated fat (about more than 20 grams per day) [42]. Alcohol consumption is measured as adults with diabetes who drink alcohol should do so in moderation (>2 for women and > 3 drinks /day for men) [43]. A patient performing moderate to vigorous physical activity for at least 150 min per week was considered as active [44]. For this study, BMI was classified into two categories ($<$ 25 and $\geq$ 25) [45] and controlled fasting blood sugar is fasting blood sugar of $\leq$130 mg/dl [46].

2.7 Data collection instrument and procedure

The data were collected using a pretested interviewer-administered questionnaire through face-to-face interviews and record reviews of recent laboratory tests and

physical examinations. The questionnaire included questions on sociodemographic, clinical, and behavioral characteristics, Perceived Diabetes Self-Management Scale (PDSMS) and problem areas in diabetes scale (PAID). The questionnaire was administered by trained data collectors after the patient consented to participate in the study.

Diabetes Distress (DD) can be assessed using one of several patient-reported outcome measures, those are: Psychological adjustment to diabetes scale (ATT39) [47], Problem Areas in Diabetes Scale (PAID) [48, 49], Questionnaire on Stress in patients with Diabetes-Revised (QSD-R) [50] and the Diabetes Distress Scale DDS (DDS-17) [5, 51]. Of those PAID and DDS are accepted assessment scales because they are statistically sound measures of Diabetes Distress [37].

In this study, we used the PAID scale (20 items) to measure negative emotions related to living with diabetes or diabetes distress, with scores 40 and above indicative of elevated or severe DRD [49, 52]. The 20-item Problem Areas in Diabetes (PAID) scale is a reliable, valid, and psychometrically robust measurement tool with a Cronbach's alpha of 0.95 [48, 53].

The PAID scale's items are focused on various diabetes-related problems (e.g., fear of hypoglycemia or long-term complications and dissatisfaction with family or doctor support; see **Table 1**). The PAID scale assigns a score to each item ranging from 0 ("no problem") to 4 ("serious problem"). A total score of 0 to 100 points is produced by adding up all 20 scores and multiplying the result by 1.25. Higher scores (cutoff ≥40) imply increased diabetes-related distress or high distress [49, 52, 54, 55]. In addition, the 20 items were analyzed separately to rank the problem areas.

Furthermore, Perceived Diabetes Self-Management Scale (PDSMS) (8-item) was used to assess diabetes self-efficacy. The overall PDSMS score can vary from 8 to 40; higher scores indicate person's level of more confidence in managing their diabetes [56]. Behavioral factors were evaluated based on the WHO STEP-wise approach for chronic disease risk factor surveillance [57]. Physical measures were made, and clinical characteristics were gathered from the patient's record. Four Bachelor of Science nurses collected the data with the supervision of two supervisors and a principal investigator.

Variable	Category	High Diabetes		P-value	Non-adjusted	Adjusted
		No, n (%)	Yes, n (%)		COR (95% CI)	AOR (95% CI)
Age group	1. <40 years	8(5.0%)	3(1.9%)		1	1
	2. 41–50 years	29(18.1%)	7(4.4%)	0.581	0.6(0.13, 3.07)	0.7(0.10, 05.87)
	3. 51–60 years	40(25.0%)	18(11.2%)	0.804	1.2(0.28, 5.05)	2.6(0.40, 17.67)
	4. 61–70 years	29(18.1%)	15(9.4%)	0.667	1.3(0.31, 5.97)	1.9(0.23, 16.06)
	5. >60 years	5(3.1%)	6(3.8%)	0.200	3.2(0.54, 18.98)	3.9(0.30, 51.04)
Sex	1. Male	60(37.5%)	22(13.8%)	0.286	0.6(0.35, 1.36)	0.6(0.19, 2.37)
	2. Female	51(31.9%)	27(16.9%)		1	1
Marital Status	1. Married	85(53.1%)	35(21.9%)		1	1
	2. Divorced	10(6.2%)	3(1.9%)	0.645	0.7(0.18, 2.80)	1.2(0.21, 7.13)
	3. Widowed	16(10.0%)	11(6.9%)	0.244	1.6(0.70, 3.95)	0.5(0.12, 2.04)

Variable	Category	High Diabetes		P-value	Non-adjusted	Adjusted
		No, n (%)	Yes, n (%)		COR (95% CI)	AOR (95% CI)
Educational status	1. Illiterate	15(9.4%)	18(11.2%)	0.000	9.3(2.94, 29.73)***	5.933(1.29, 27.11)*
	2. Primary school	38(23.8%)	15(9.4%)	0.046	3.0(1.01, 9.30)*	2.4(0.58, 10.38)
	3. Secondary school	19(11.9%)	11(6.9%)	0.013	4.5(1.37, 14.85)*	4.6(1.08, 19.59)*
	4. College/University	39(24.4%)	5(3.1%)		1	1
Occupation	1. Gov't employee	27(16.9%)	7(4.4%)		1	1
	2. Private work	32(20.0%)	10(6.2%)	0.738	1.2(0.40, 3.59)	0.7(0.18, 3.02)
	3. Retired	16(10.0%)	5(3.1%)	0.779	1.2(0.32, 4.43)	0.9(0.19, 4.42)
	4. Unemployed	36(22.5%)	27(16.9%)	0.032	2.8(1.09, 7.62)*	1.6(0.41, 6.35)
BMI	1. Normal weight	56(35.0%)	31(19.4%)		1	1
	2. Over weight	39(24.4%)	11(6.9%)	0.099	0.5(0.22, 1.13)	0.3(0.10, 1.09)
	3. Obesity	16(10.0%)	7(4.4%)	0.642	0.7(0.29, 2.12)	1.0(0.27, 4.26)
Living arrangement	1. Living with family	104(65.0%)	48(30.0%)		1	1
	2. Living alone	7(4.4%)	1(0.6%)	0.279	0.3(0.03, 2.58)	0.2(0.02, 3.93)
Diabetes treatment regimen	1. Insulin only	29(18.1%)	6(3.8%)		1	1
	2. Insulin & OHA*	9(5.6%)	2(1.2%)	0.937	1.0(0.18, 6.28)	1.6(0.21, 12.93)
	3. OHA*	73(45.6%)	41(25.6%)	0.041	2.7(1.04, 7.08)*	1.9(0.57, 6.63)
Confidence in DMS	1. Less Confident	62(38.8%)	35(21.9%)	0.065	1.9(0.95, 4.07)	2.0(0.78, 5.61)
	2. More Confident	49(30.6%)	14(8.8%)		1	1
Follow Healthy diet	1. Yes	57(35.6%)	30(18.8%)		1	1
	2. No	54(33.8%)	19(11.9%)	0.249	0.6(0.33, 1.32)	0.5(0.20, 1.49)
Alcohol consumption	1. > 3 drinks per occasion	10(6.2%)	14(8.8%)	0.002	4.0(1.64, 9.91)**	2.8(0.94, 8.59)
	2. Never & Once a month	101(63.1%)	35(21.9%)		1	1
Physical exercise	1. Inactive	47(29.4%)	12(7.5%)	0.033	0.4(0.20, 0.93)*	0.395(0.16, 0.95)*
	2. Active	64(40.0%)	37(23.1%)		1	1
Type of institution	1. ACSH	68(42.5%)	12(7.5%)		1	1
	2. MGH	43(26.9%)	37(23.1%)	0.000	4.8(2.29,10.37)***	3.224(1.26, 8.20)*

OHA: Oral Hypoglycemic Agent, DSM: diabetes self-management.*Significant at $p < 0.05$;Significant at $p < 0.01$;***Significant at $p < 0.0001$.*

Table 1.
Socio-demographic characteristics versus diabetes distress among type 2 diabetes (T2D) patients at ACSH and MGH in Tigray region, northern Ethiopia, 2021 (n = 160).

2.8 Data quality assurance

Investigators were provided training about data collection tools and the aim of the study for data collectors and supervisors to ensure data quality. Moreover, the data collection tool was pretested prior to the actual data collection on 5% of the sample size at Quiha General Hospital 2 weeks before the actual data collection period. The necessary amendment was done according to the pretest result. The collected data were examined for completeness and consistency daily at the site during the data collecting period.

2.9 Data analysis

The data were cleaned and checked for completeness and consistency before analysis was started. The data entry was done using Epi-Info version 7 and export to SPSS version 20 for analysis. All continuous data were presented as mean standard deviation (SD), categorical data were described by frequencies, and an unpaired t-test was used for continuous variables to compare two groups. Binary logistic regression analysis model was used to identify risk factors. Hosmer & Lemeshow and Collinearity tests were done to check for model fitness and effect modifiers, respectively. Variables with $p < 0.05$ during the bivariate analysis were then included in the multivariable logistic regression for further analysis. $P < 0.05$ was considered as the cutoff point to declare a variable that shows statistically significant association in multivariable analysis. The strength of the statistical association of factors associated with diabetes distress was demonstrated by computing the adjusted odds ratio (AOR) and 95% confidence interval (CI).

2.10 Ethical consideration

Ethical approval to conduct the research was obtained from the Institutional Review Board (IRB) of Mekelle University. The study was conducted in accordance with the declaration of Helsinki; study participants were recruited voluntarily after obtaining informed consent, and participants were informed of their rights to withdraw from the study at any stage. Information was recorded anonymously, and confidentiality and beneficence were assured throughout the study.

3. Results

3.1 Sociodemographic characteristics of participants

A total of 173 T2D were recruited. Thirteen patients' questionnaires were excluded from data analysis because they did not have sufficient data; hence, the final sample consisted of 160 (92.48%) eligible T2D patients. The majority were aged 40 to 70 years old (86.25%) with mean ± SD age of 56.5 ± 9.6 years (range 32–80 years old), and the mean BMI of the participants was 25.2 ± 3.9 (ranging from 18.5 to 37.1). Most were male (51.2%), married (75.0%), had at least some formal education (79.4%), normal weight (54.4%), unemployed (39.4%), and live with family (95.0%) of which 13.8, 21.9, 19.4, 16.9, 19.4, and 30.0% had high DRD, respectively (**Table 2**).

3.2 Clinical and Behavioral characteristics of participants

Of the total study participants (78.9%) were taking OHA, 80.6%, 72.5%, 51.2%, 68.1%, and 55.6% had a diabetes duration of <10 years, FBG of >130 mg/gl., SBG of <139.99 mmhg, DBP of <89.99 mmhg, and hypertension in which 25.6, 24.3, 21.2, 16.2, 23.8, and 15.6% had high DRD, respectively. Similarly, 57.5, 54.4, 69.4, and 88.1% were more confident in diabetes self-management practices, followed a healthy diet, consumed vegetables <4 servings per week, and adhered to diabetes medication in which 8.8, 18.8, 20.0, and 28.1% had high DRD, respectively. Moreover, 93.1, 95.0,

Variable	Category	High Diabetes		Total
		No, n (%)	Yes, n (%)	
Diabetes treatment regimen	1. Insulin only	29(18.1%)	6(3.8%)	35(21.9%)
	2. Insulin & OHA*	9(5.6%)	2(1.2%)	11(6.9%)
	3. OHA*	73(45.6%)	41(25.6%)	114(71.2%)
Duration of diabetes (years) (7.5 ± 6.2)	1. < 5 years	44(27.5%)	21(13.1%)	65(40.6%)
	2. 5–10 years	46(28.8%)	18(11.2%)	64(40.0%)
	3. > 10 years	21(13.1%)	10(6.2%)	31(19.4%)
*FBG(mg/dl) control (170 ± 58.1)	1. Good (≤130 mg/dl)	29(18.1%)	15(9.4%)	44(27.5%)
	2. Not good (≥131 mg/dl)	82(51.2%)	34(21.2%)	116(72.5%)
*SBP(mmHg) (138.5 ± 20.2)	1. < 139.99 mmHg	56(35.0%)	26(16.2%)	82(51.2%)
	2. > 140.00 mmHg	55(34.4%)	23(14.4%)	78(48.8%)
*DBP(mmHg) (84. ± 9.2)	1. < 89.99 mmHg	71(44.4%)	38(23.8%)	109(68.1%)
	2. > 90–00 mmHg	40(25.0%)	11(6.9%)	51(31.9%)
Hypertension	1. Yes	64(40.0%)	25(15.6%)	89(55.6%)
	2. No	47(29.4%)	24(15.0%)	71(44.4%)
Confidence in self-managing of diabetes	1. Less Confident	62(38.8%)	35(21.9%)	68(42.5%)
	2. More Confident	49(30.6%)	14(8.8%)	92(57.5%)
Follow Healthy diet	1. Yes	57(35.6%)	30(18.8%)	87(54.4%)
	2. No	54(33.8%)	19(11.9%)	73(45.6%)
Vegetable consumption per week	1. <4 servings	79(49.4%)	32(20.0%)	111(69.4%)
	2. > 4 servings	32(20.0%)	17(10.6%)	49(30.6%)
Adherence to diabetic Medication	1. Adhere	96(60.0%)	45(28.1%)	141(88.1%)
	2. Not adhere	15(9.4%)	4(2.5%)	19(11.9%)
Days, in which glucose was measured/wk.	1. Not measured at all	103(64.4%)	46(28.8%)	149(93.1%)
	2. 1–2 days	8(5.0%)	3(1.9%)	11(6.9%)
Ever smoked tobacco products (Smoking)	1. Yes	7(4.4%)	1(0.6%)	8(5.0%)
	2. No	104(65.0%)	48(30.0%)	152(95.0%)
Alcohol consumption	1. > 3 drinks per occasion	10(6.2%)	14(8.8%)	24(15.0%)
	2. Never & Once a month	101(63.1%)	35(21.9%)	136(85.0%)
Physical exercise	1. Inactive	47(29.4%)	12(7.5%)	59(36.9%)
	2. Active	64(40.0%)	37(23.1%)	101(63.1%)

**OHA: Oral Hypoglycemic Agent, SBP: Systolic blood Pressure, DBP: Diastolic blood pressure, FBG: Fasting Blood Glucose.*

Table 2.
Clinical and behavioral characteristics versus diabetes distress among type 2 diabetes (T2D) patients at ACSH and MGH in Tigray region, northern Ethiopia, 2021 (n = 160).

85.0, and 63.1% were measured their blood glucose 1–2 days per week, never smoked, never, or drink once per month, and physically active in which 28.8, 30.0, 21.9, and 23.1% had DRD, respectively (**Table 3**).

Item	All (n = 161)	ACSH (n = 80)	MGH (n = 80)	P-value*
1. Not having clear and concrete goals for your care?	1.6±1.4	1.7±1.5	1.6±1.4	0.598
2. Feeling discouraged with your diabetes treatment plan?	0.7±1.2	0.6±1.2	0.9±1.2	0.255
3. Feeling scared when you think about living with diabetes?	1.0±1.3	0.9±1.3	1.1±1.3	0.415
4. Uncomfortable social situations related to your diabetes care?	0.8±1.2	0.6±1.1	0.9±1.3	0.204
5. Feelings of deprivation regarding food and meals?	1.0±1.2	1.1±1.4	0.8±1.0	0.072
6. Feeling depressed when you think about living with diabetes?	1.4±1.3	1.3±1.2	1.5±1.4	0.251
7. Not knowing if your mood or feelings are related to your diabetes?	1.5±1.4	1.2±1.4	1.8±1.4	0.007
8. Feeling overwhelmed by your diabetes?	1.4±1.3	1.1±1.2	1.7±1.4	0.005
9. Worrying about low blood sugar reactions?	1.6±1.2	1.6±1.2	1.7±1.3	0.539
10. Feeling angry when you think about living with diabetes?	1.2±1.3	0.6±1.1	1.6±1.4	<0.001
11. Feeling constantly concerned about food and eating?	1.4±1.2	1.2±1.2	1.5±1.2	0.189
12. Worrying about the future and the possibility of serious complications?	2.1±1.2	2.1±1.2	2.1±1.2	0.948
13. Feeling of guilt or anxiety when you get off track with your diabetes management?	1.6±1.2	1.7±1.1	1.5±1.2	0.342
14. Not "accepting" your diabetes?	0.7±1.2	0.3±1.0	1.1±1.3	<0.001
15. Feeling dissatisfied with your diabetes physician?	0.8±1.3	0.4±1.0	1.2±1.5	<0.001
16. Feeling that diabetes is taking up too much of your mental and physical energy every day?	2.1±1.3	1.9±1.4	2.3±1.3	0.096
17. Feeling alone with your diabetes?	0.8±1.2	0.5±1.1	1.0±1.3	0.012
18. Feeling that your friends and family are not supportive of your diabetes management efforts?	1.1±1.4	1.0±1.4	1.2±1.3	0.377
19. Coping with complications of diabetes?	2.1±1.2	2.0±1.1	2.2±1.3	0.220
20. Feeling "burned out" by the constant effort needed to manage diabetes?	1.7±1.3	1.4±1.3	2.0±1.3	0.005
Total PAID score (range 0–100)	34.1±15.3	30.2±14.0	38.0±15.7	0.001

**Significant difference of DRD Between participants from ACSH and MGH.*
ACSH: Ayder Comprehensive Specialized hospital, MGH: Mekelle general hospital.

Table 3.
Mean score (range 0–4) of each item of the PAID questionnaire.

3.3 Diabetes distress (DD)

Overall, the average PAID score among the participants was 34.3 ± 15.5 (range 6–85) and 30.6% (49/160) (95% CI: 23.1–37.5) of participants showed high levels of distress with PAID scores ≥40. The items scoring highest were (in descending order): "Feeling diabetes is taking up too much energy every day" (mean PAID score 2.1 ± 1.3), "Worrying about the future and serious complications" (2.1 ± 1.2),

"Feeling 'burned out' by the constant effort needed to manage diabetes (1.7 ± 1.3), not having clear and concrete goals for diabetes care (1.6 + 1.4) and "Worrying about hypoglycemia" (1.6 ± 1.2). The items scoring lowest were: "Feeling discouraged with diabetes treatment plan" (0.7 ± 1.2) and "Not 'accepting' diabetes diagnosis (0.7 ± 1.2). The number of participants with a PAID score ≥ 40 (15.0% vs. 46.0%, p = 0.014) and mean PAID score (30.2 ± 14.0 vs. 38.0 ± 15.7, p = 0.001) were higher among participants from MGH than ACSH (**Table 1**).

3.4 Factors associated with diabetes distress

Binary logistic regression model was used to analyze the data in order to identify factors associated with diabetes distress (DD). In the bivariate analysis, level of

Variable	Category	High Diabetes		Total
		No, n (%)	Yes, n (%)	
Age group (56.5 ± 9.6)	1. <40 years	8(5.0%)	3(1.9%)	11(6.9%)
	2. 41–50 years	29(18.1%)	7(4.4%)	36(22.5%)
	3. 51–60 years	40(25.0%)	18(11.2%)	58(36.2%)
	4. 61–70 years	29(18.1%)	15(9.4%)	44(27.5%)
	5. >71 years	5(3.1%)	6(3.8%)	11(6.9%)
Sex	1. Male	60(37.5%)	22(13.8%)	82(51.2%)
	2. Female	51(31.9%)	27(16.9%)	78(48.8%)
Marital Status	1. Married	85(53.1%)	35(21.9%)	120(75.0%)
	2. Divorced	10(6.2%)	3(1.9%)	13(8.1%)
	3. Widowed	16(10.0%)	11(6.9%)	27(16.9%)
Educational level	1. Illiterate	15(9.4%)	18(11.2%)	33(20.6%)
	2. Primary school (1–8 grade)	38(23.8%)	15(9.4%)	53(33.1%)
	3. Secondary school (9–12 grade)	19(11.9%)	11(6.9%)	30(18.8%)
	4. College/University	39(24.4%)	5(3.1%)	44(27.5%)
Occupation	1. Gov't employee	27(16.9%)	7(4.4%)	34(21.2%)
	2. Private work	32(20.0%)	10(6.2%)	42(26.2%)
	3. Retired	16(10.0%)	5(3.1%)	21(13.1%)
	4. Unemployed	36(22.5%)	27(16.9%)	63(39.4%)
*BMI (25.2± 3.9)	1. Normal weight (18.50–24.99)	56(35.0%)	31(19.4%)	87(54.4%)
	2. Over weight (25.00–29.99)	39(24.4%)	11(6.9%)	50(31.2%)
	3. Obesity (>30.00)	16(10.0%)	7(4.4%)	23(14.4%)
Living arrangement	1. Living with family	104(65.0%)	48(30.0%)	152(95.0%)
	2. Living alone	7(4.4%)	1(0.6%)	8(5.0%)

**BMI: Body Mass Index.*

Table 4.
Multivariate logistic regression of factors associated with DRD among type 2 diabetes (T2D) patients in ACSH and MGH, Tigray region, northern Ethiopia, 2021 (n = 160).

education, occupation, diabetes treatment regimen, alcohol consumption, physical exercise, and type of institution were identified as factors associated with DD at $P < 0.05$. However, age, sex, marital status, BMI, living arrangement, following a healthy diet, and confidence in diabetes management were not significantly associated with DD.

In the multivariate analysis, the odds of having high DD were six times higher in illiterate participants [AOR = 5.9; 95% CI: 1.29–27.11, P = 0.022)] than those who attend university/college level education. The result showed that being physically active decreases the probability of developing high DD by 60.5% [AOR = 0.395; 95% CI: 0.16–0.95), P = 0.040] than their counterpart. Participants who had diabetes care follow-ups at the secondary hospital (MGH) were three times more likely to develop high DD [AOR = 3.2; 95% CI = (1.26, 8.20), P = 0.014] than those who had regular visits at the tertiary hospital (ACSH). However, there were no associations between high PAID score and occupation, diabetes treatment regimen, and alcohol consumption (**Table 4**).

4. Discussion

To the best of our knowledge, this is the first study to use PAID tool in a clinical context to measure the prevalence of diabetes distress (DD) and its associated factors among people with T2D in Mekelle City, Tigray. Our sample consisted of patients attending a secondary or tertiary care outpatient center. Three-forth participants were less than 60 years old, most of them lived with family, were illiterate, and had been diagnosed with T2D more than 5 years before the study. The study showed that approximately one-third of patients with T2D in Mekelle City suffer from DM-related distress.

In this study, the prevalence of DD with PAID scores ≥40 was 30.6% (95% CI: 23.1–37.5), which is in line with figure reported from studies conducted in Nigeria (26.4%), Taif city Saudi Arabia (25.0%), Brazil (31.5%), and Germany (23.8%) [53, 58–60], this is higher than study conducted in Greece (7.4%), Thailand (1.1%), Riyadh-Saudi Arabiya (10.0%), HoChi Mini City, Vietnam (5.8%), Jazan Saudi Arabia (5.0%), Southwest Ethiopia (4.4%), India (18%), and Kuwait (14%) [61–68] but lower than studies conducted in Ghana 44.7% and Thai Bin, Vietnam 50.0% [69, 70].

The variations in population characteristics or assessment tools used in this study may be the cause of the difference in the prevalence of DD. One of the reasons for the lower prevalence reported in other studies compared to ours could be due to differences in the assessment tools, which could potentially affect prevalence. For instance, a study in Greece, Thailand, Riyadh-Saudi Arabiya, Ho Chi Mini City Vietnam, Jazan Saudi Arabia, South west Ethiopia and India (65–71) uses DDS-17, but our study uses a PAID assessment scale.

Another reason for lower prevalence reported in other studies might be due to a difference in diabetes duration of the study populations, e.g., study findings from Saudi Arabia and Vietnam showed that (34.4%) and (29.7%) study populations had diabetes duration of less than 5 years respectively [63, 64], which is lower than the proportion of our study population. Therefore, the higher proportion of participants with longer diabetes duration could be the possible reason for the higher prevalence of DD in our study because diabetes with long duration has been shown to have a psychiatric effect on the patient's quality of life.

However, in contrast to our study, the majority of study population from a study conducted in Ghana (54.7%) [69] and Thai Bin Vietnam (74.8%) [70] were more than

60 years old, thus there was a higher tendency of distress among the older population [71] and differences in sample sizes could also explain the observed lower prevalence in our study.

Moreover, higher prevalence of DD in our study than in Greece and Thailand could be due to difference in study setting. For instance, our study was conducted at secondary and tertiary hospitals but studies from Greece [61] and Thailand [62] were done at primary care (PC) units or centers because the approach of healthcare providers in addressing diabetes psychological issues across the levels of care might vary [72].

This study found that education level ($p = 0.022$), physical exercise ($p = 0.040$), and type of institution ($p = 0.014$) were significantly associated with high diabetes distress. Similarly, previous studies indicated that the risk factor for high diabetes distress scores was low education level [59, 61, 66, 67]. This relationship may be occurred because of low education leading to lack of awareness about diabetes and its complications, which, in turn, increases the risk of poor glycemic control as a result of poor adherence to healthy diet, medication, and fewer health check-ups.

In this study, physically active patients were 60.5% less likely to have high DD than those who were physically inactive; this is in line with studies from other countries [59, 61, 65]. When patients maintain proper glycemic control by adhering to recommended physical exercise and other self-management modalities, they may not develop diabetes-related distress. In this study, subjects who attended a general hospital (MGH) for their diabetes care visit had significantly higher distress scores compared to those who attended a tertiary hospital (ACSH). This is probably related to variations in diabetes care and healthcare providers' approach to addressing diabetes-related psychological issues.

However, age, sex, marital status, occupation, diabetic complications, duration of DM, family support, treatment regimen, and HbA1c level were not significantly associated with diabetes-related distress. The results of the present study are consistent with studies done in other countries, which reported that the total DDS score was not significantly related to patients' age, gender, diabetes duration, marital status, or household income [53, 67, 68]. A study showed that DD is associated with gender, age and duration of diabetes, income, and glycemic status [65]. These findings suggest that other factors may affect DD, e.g., hypoglycemia episode [53, 61, 63], types of diabetes [48, 58], and family support [62, 66].

When interpreting the results of this study, it is important to be aware of the potential limitations; the limitations of this study are: First, because the study relied on participant self-report data, there may be recall bias. Second, the study's cross-sectional design makes it difficult to conclude the cause-and-effect relationship and its direction between DD and independent variables. Third, although we used valid subjective methods to assess DD, clinical objective methods remain the gold standard for diagnosing DD. Lastly, our findings need cautious generalization due to the biases stemming from the relatively small sample size, recall, and social desirability biases.

5. Conclusion

This study showed a high prevalence of high Diabetes Distress (DD) (30.6%) among type 2 diabetes patients in Mekelle City, northern Ethiopia. Education level,

physical activity and study setting (type of health facility) were the risk factors associated to increased prevalence of diabetes-related distress. This implies that DD needs special care from healthcare professionals to prevent and minimize it through integrating psychosocial care with collaborative medical care by combining the evaluation for distress as part of regular procedures into diabetes care in order to increase self-care practices and coping skills. Furthermore, further large-scale studies to identify the causality of DRD are recommended to substantiate our findings.

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Conflict of interest

This manuscript maintains no competing interest of financial, political, personal, religious, ideological, academic, intellectual, commercial, or any other from any person or organization.

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