Treatment outcome and its predictors among diabetic patients attending at selected hospitals of southern ethiopia.

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Abstract

Background: Diabetes is one of the largest health emergencies of the 21st century. The World Health Organization (WHO) estimates that globally, hyperglycaemia is the third highest risk factor for premature mortality, after high blood pressure and tobacco use. It is an important cause of blindness, kidney failure, lower limb amputation and other long-term consequences that impact significantly on quality of life. It results in a disease, death and increases health care expenditure.

Objectives: To determine treatment outcome of Diabetes mellitus and its predictors among patients attending diabetes treatments at selected hospitals of southern Ethiopia, 2021.

Methods: All diabetic patients who attended selected hospitals of southern Ethiopia were a source population. Institution based cross-sectional study design was conducted at selected hospitals of southern Ethiopia. Patient's data was collected using pretested questionnaire. After cleaning and checking for errors, the data was entered into Epi-data to minimize error then exported to SPSS for analysis. Descriptive findings were presented by tables and charts. The outcome variable was analyzed by using logistic regression model to identify predictors after assumptions of regression analysis had been checked. All the independent variables with $p < 0.25$ were used as candidates for multivariate analysis. Then the level of significance was set at $p < 0.05$ and AOR with 95% CI was done as the final model.

Result: From the total sample; 277 (65.6%) were found to be good treatment outcome. The number of medication taken AOR 95%CI; 0.924 (0.869, 0.983), presence of complication AOR 95%CI; 0.425 (0.217, 0.832), increased fasting blood glucose AOR 95%CI; 0.080 (0.034, 0.188) were found to be independent predictors. Since the magnitude of treatment outcome was found to be low, provision of health information about adhering to prescribed medication and monitoring fasting blood glucose level will bring good clinical outcome.

Introduction

Diabetes mellitus is not a single disease entity but rather a group of metabolic disorders sharing the common underlying feature of hyperglycaemia, which results from defects in insulin secretion, insulin action, or both(1). According to the 2015 report of IDF, about 415 million people worldwide, or 8.8% of adults aged 20–79 years, were estimated to have DM. Of these, about 75% lived in low- and middle-income countries. If these trends continue, by 2040, some 642 million people (or one in ten adults) will have DM. The largest increases will take place in the regions where economies are moving from low-income to middle-income levels. In 2015, the IDF also estimated that, in the Africa region, 14.2 million adults aged 20–79 years had diabetes, representing a prevalence of 3.2 % (2). Poor diabetes outcome leads to complications in many parts of the body and can increase the overall risk of dying prematurely. Possible complications include heart attack, stroke, kidney failure, leg amputation, vision loss and nerve damage. In pregnancy, poorly controlled diabetes increases the risk of fetal death and other complications (3). The World Health Organization (WHO) estimates that globally, hyperglycaemia is the third highest risk factor for premature mortality, after high blood pressure and tobacco use (4). It results in a disease, death and increases a

health care expenditure (5). It is the leading cause of end-stage renal disease (ESRD), traumatic lower extremity amputations, and adult blindness. It also predisposes to cardiovascular diseases. With an increasing incidence worldwide, DM will be a leading cause of morbidity and mortality in the future. The goal of treatment for DM is to prevent mortality and complications by normalizing blood glucose level. But blood glucose level might be increased despite appropriate therapy resulting in complications, such as disturbances in fat metabolism, nerve damage, and eye disease (4, 6). Diabetes is a major cause of blindness, kidney failure, heart attacks, stroke and lower limb amputation (7).

Ethiopia is among the top four countries with the highest adult diabetic populations in sub-Saharan Africa. In Ethiopia According to IDF 2017 Country report the total country prevalence of diabetes mellitus was 5.2%, Number of people with diabetes was 2,567,900, Number of people with undiagnosed diabetes was 1,960,300, Number of deaths due to diabetes was 31,000 which accounts 81.8% of deaths due to diabetes in people under 60 years. Patient attendance rates and medical admissions related to diabetes in major hospitals have been rising. In Addis Ababa Ethiopia diabetes-related admissions in have increased from 7% in 2005 to 34% in 2009 (8). This requires a shift in healthcare priorities and up-to-date data on treatment outcome and its predictors in Ethiopia. The consequences of diabetes due to poor control of sugar in Ethiopia ranges from acute complication like DKA, chronic complication and death.

However, there no research evidences in the study area showing treatment outcomes and predictors. So, the aim of this study is to assess treatment outcome and its predictors in the study area in which it provides input for health care providers and institution.

Objectives

General objective

To assess treatment outcome and its predictors among DM patients attending treatments at selected hospitals of Southern Ethiopia, 2021

Specific Objective

To identify treatment outcome of DM patients attending at selected hospitals of southern Ethiopia, 2021

To identify predictors of treatment outcome among DM patients attending treatments at selected hospitals of southern Ethiopia, 2021

Methods And Materials

Methods and materials

Study area and period:

Study area:

The study was conducted at 3 selected hospitals called Hawassa university comprehensive specialized hospital, Wolaita Sodo University Teaching Referral Hospital and Nigist ellen general hospital. Hawassa University Comprehensive Specialized Hospital is a teaching Hospital located 275 km south of Addis Ababa, in Hawassa town Sidama region. Nigist Ellen Mohammed Memorial hospital is the General hospital found in Hadiya Zone, which is 230 kilometer from Addis Ababa. Wolaita Sodo University Teaching Referral Hospital is also found in Sodo town which is 328km from Addis Ababa

Study period

The study was conducted from October 24, 2021- February, 30, 2021

Study design

Institution based cross sectional study design had been conducted at selected hospitals of southern Ethiopia.

Source population

All diabetic patients who attended selected hospitals of southern Ethiopia during study period.

Study population

All sampled DM patients who attended outpatient department at selected hospitals of southern Ethiopia during the study period

Inclusion and exclusion criteria

All diabetic patients who attended outpatient department at selected hospitals in southern Ethiopia who can give informed consent will be included. Whereas, those who are not volunteer have been excluded

Sample size

Sample size calculation is based on the single population proportion formula.

$N = [(Z_{\alpha/2})^2 P (1 - P)] / d^2$ is used.

N= is sample size,

$Z_{\alpha/2}$ is Z value which is 1.96 at 95% confidence interval,

P is proportion of diabetic patients and is taken 0.5 and d is marginal error which is 0.05.

At 95% confidence interval and by taking p value of 0.5 just to maximize the sample size; in order to accommodate the maximum variety of patients coming to the diabetic clinics, the sample size will be 384. Adding 10% non-respondent rate, the final sample size will be 422.

Sampling Technique

The study area was selected randomly using lottery method from those hospitals found in southern region of Ethiopia. Proportionate sample allocation was done to allocate samples for each hospital of Adare general hospital, Nigist Ellen general hospital and Wolayta sodo general hospital. So, every patient having appointment during study period was selected since patients visiting the health institutions are random in nature till the maximum number of sample size will be achieved. So, exit interview was conducted at each hospital.

Variables

Dependent Variable

Treatment outcome

Independent Variables

Socio demographic variables

- Age, Sex, educational status, marital status, income and job status.

Behavioral Variables are: - Alcohol drinking, cigarette smoking, Khat chewing, Physical activity practice, practices to prescribed diet regimen.

Disease and medication related Variables are: - Duration of Diabetes, Type of treatment, co-morbid illness, Fasting blood glucose level, DM control, Medication adherence

Data collection Instrument

In order to collect data from the patient, Data abstraction sheets, structured questionnaire and observation checklist was used. Data abstraction sheets were developed by investigator by reviewing different literature to collect relevant information from patient charts and laboratory results. Structured questionnaire for face to face interview was used. World health organization guideline (WHO), 2012) have been used to obtain patient adherence level. The questionnaires have 6 parts, including socio-demographic information, Patient's Physical activity questions, World to determine medication adherence. The questionnaire also include laboratory and medication related variables. The data have been collected by 11 BSc Nurses and 3 M.Sc. health professionals had supervised data collection process. At the end the outcome will be measured which may be good or poor treatment outcome

Data processing and analysis

After checking collected data visually for completeness, the responses was cleaned, edited, coded and entered into the computer using Epi-data version 3.1. The data will be then exported to SPSS version 20.0. The data will be checked for missed value before analysis. The descriptive analysis including frequency will be used to assess frequency of variables with independent variables. Binary logistic regression will be carried out to assess the association of treatment outcome of DM with independent variables to determine predictors of treatment outcome having odds ratios with 95% confidence interval. Finally forward stepwise

logistic regression model with all independent variables having p value <0.25 will be fitted and adjusted odds ratio will be calculated to identify independent predictors of treatment outcome of DM.

Data Quality

To assure quality of the data, properly designed data collection tool was prepared, pretested in hospital which would not be selected to check for understandability and applicability of the instrument and 3 day training will be given to data collectors and supervisor. Besides, on each data collection day, the collected data was reviewed and checked for its completeness by supervisor and principal investigator. Then data was checked and entered into Epi-data version 3.1 for double data entry verification.

Ethical Considerations

In order to follow the ethical and legal standards of scientific investigation, the study was conducted after approval of the proposal by Ethical Review Committee of Hawassa University. Permission for conduct of study was obtained from authorities at selected hospitals. Written informed consent was obtained from each study participant by assuring privacy and confidentiality throughout the data collection period in the Hospital. Individuals who were unwilling to participate from the beginning or at any part of the interview were allowed to withdraw. There was no risk or hazardous procedures putting the participants at harm.

Result

Socio demographic characteristic of the respondents

Out of total 422 sampled diabetes patients; yield a response rate of 100%. Among them 276 (62.3%) and 310(70%) were male and married respectively. The mean age for the participants was 46.51 with SD of 13.85. (See table 1below).

Table 1
Socio demographic characteristics and factors associated with medication adherence for
the respondents at selected hospitals of southern Ethiopia, 2021 (n=422)

S.N	Sociodemographic variables	Categories	Frequency	Percent
1	Age	young age gruop	140	33.2
		middle age gruop	139	32.9
		old age gruop	143	33.9
1	Sex	male	264	62.6
		female	158	37.4
2	Address	urban	277	65.6
		rural	145	34.4
3	Region	SNNPR	326	77.3
		Sidama	96	22.8
4	Marital status	single	82	19.4
		married	304	72.0
		Widow/divorced	36	8.5
5	Religion	protestant	264	62.6
		orthodox	104	24.6
		catholic	4	0.9
		muslim	46	10.9
		others	4	0.9
7	Educational status	illiterate	40	9.5
		readandwrite	49	11.6
		grade1-8	113	26.8
		grade10-12	97	23.0
		College above	123	29.1
8	Occupational status	Un employeed	11	2.6
		retired	45	10.7
		students	32	7.6
		disabled	1	.2
		housewife	79	18.7

S.N	Sociodemographic variables	Categories	Frequency	Percent
		marchant	45	10.7
		Daily labourer	4	.9
		farmer	68	16.1
		Government employeed	95	22.5
		Private employeed	9	2.1
		others	33	7.8
9	Income	low income group	136	32.2
		middle income group	145	34.4
		high income guop	141	33.4

Behavioural characteristics and factors

From the respondents; those participants who didn't drink alcohol and smoke cigarate were 95.7 % and 98.1 % respectively. (see Table 2 below).

Table 2
Behavioural related characteristics for the respondents at selected hospitals of southern Ethiopia, 2021 (n=422).

S. N	Behavioural factors	Categories	frequency	percent
1	Dietary practice	poor practice	180	42.7
		good practice	242	57.3
2	Physical activity	Inactive(poor)	258	61.1
		Active (good)	164	38.9
3	Alcohol drinking	yes	18	4.3
		no	404	95.7
4	Smoke cigarette	yes	8	1.9
		no	414	98.1

Disease and medication related characteristics

In this study 365 (82.4%) were type II diabetes and 277 (62.5%) had developed complication. Regard to medication adherence and treatment outcome; 195 (44%) and 290 (65.5%) were found to be poor and good adherence and outcome respectively. (See Table 3 below)

Table 3
Disease and medication related characteristics for the respondents at selected hospitals of southern Ethiopia, 2021 (n=422).

Disease and medication related factors		Categories	frequency	percent
1.	Past hx of admission due to DM	yes	284	64.1
		no	159	35.9
2	Presence of complication	yes	267	63.3
		no	155	36.7
3	Type of complication	DKA	195	46.2
		hbnks	21	5.0
		others	44	10.4
		hypoglycemia	7	1.7
4	Type of DM	type1	143	33.9
		type2	272	64.5
		others	7	1.7
5	MAT (Medication Adherence)	not adhered	16	3.8
		adhered	406	96.2
6	RX 3(current DM medication intake)	insulin	175	41.5
		Oral	247	58.5
9	Blood glucose level	FBS between 60-140	132	31.3
		FBS >= 140	290	68.7
10	Frequency of Blood glucose Level measurement	never	29	6.9
		once	31	7.3
		sometimes	167	39.6
		mostly	99	23.5
		always	96	22.7

Prevalence of treatment outcome

From the total sample the treatment outcome 277 (65.6%) were good. Whereas 145 (34.4%) were found to be poor.

Sociodemographic factors associated with treatment outcome

From the sociodemographic variables affecting the respondents; only marital status and educational status were found to be associated significantly with the treatment outcome. (See Table 4 below).

Table 4
Sociodemographic factors associated with treatment outcome among the respondents at selected hospitals of southern Ethiopia, 2021 (n=422).

S.n	Variables	category	Glycemic control		Exp(B)	95% C.I.for EXP(B)		p-value
			Good	poor		Lower	Upper	
1	Age	young	88(31.8)	52(35.9)	0.921	0.565	1.502	0.511
		middle	90(32.5)	49(33.8)				
		old	99(35.7)	44(30.3)				
2	Sex	male	172(62.1)	92(63.4)	1.060	0.699	1.607	0.78
		Female	105(37.9)	53(36.6)				
3	address	Urban	190(68.6)	87(60.0)	0.687	0.452	1.043	0.078
		Rural	87(31.4)	58(40.0)				
4	Marital status	single	58(20.9)	24(16.6)	3.103	.659	14.625	0.033
		married	188(67.9)	116(80.0)	4.628	1.039	20.604	
		Widow/divorced	31(11.2)	5(3.5)	1.406	.206	9.619	
5	Educational status	illiterate	22(7.9)	18(12.4)	1.977	.949	4.120	0.04
		Read and write	39(14.1)	10(6.9)	.620	.280	1.373	
		grade1-8	66(23.8)	47(32.4)	1.721	1.004	2.951	
		grade10-12	63(22.7)	34(23.4)	1.304	.738	2.306	
		College and above	87(31.4)	36(24.8)				0.443
7	Income	low	69(28.2)	31(22.0)	0.769	0.446	1.326	0.355
		middle	87(35.5)	58(41.1)				
		high	89(36.3)	52(36.9)	1.141	0.708	1.838	

Behavioural factors affecting treatment outcome

From the four behavioural variables included in the study; none of them were found to be associated significantly (See Table 5 below).

Table 5

Behavioural factors associated with treatment outcome among the respondents at selected hospitals of southern Ethiopia, 2021 (n=422).

S.n	Variables	category	Glycemic control		Exp(B)	95% C.I.for EXP(B)		p-value
			Good	poor		Lower	Upper	
1	Alcohol	yes	11(4)	7(4.8)	0.815	0.309	2.150	0.68
		No	266(96)	138(95.2)				
2	Smoking	yes	3(1.1)	5(3.4)	0.307	0.072	1.301	0.109
		No	274(98.9)	140(96.6)				
3	Dietary practice	poor	112(40.4)	68(46.9)	1.317	0.877	1.97	0.184
		good	165(59.6)	77(53.1)				
4	Physical activity	inactive	173(62.5)	85(58.6)	0.852	0.565	1.284	0.443
		active	104(37.5)	60(41.4)				

Disease and medication related factors associated with treatment outcome

From eight variables studied under disease and medication related factor ; the following four factors called Past history of admission, Type of complication, Blood glucose Check-up and Blood glucose level were found to be associated significantly (See Table 6 below).

Table 6
behavioural factors associated with treatment outcome among the respondents at selected hospitals of
southern Ethiopia, 2021 (n=422).

S.n	Variables	category	Gycemic control		Exp(B)	95% C.I.for EXP(B)		
			Good	poor		Lower	Upper	
1	Past history of admission	yes	164(59.2)	103(71.0)	1.690	1.098	2.601	0.017
		No						
2	Presence of complication	yes	176(63.5)	91(62.8)	0.967	0.638	1.466	0.875
		No						
3	Type of complication	DKA	121(77.1)	64(64.6)	0.465	0.259	0.833	0.035
		hyperglycemia	36 (22.9)	35(35.4)				
4	Type of DM	Type I	90(32.5)	53(36.6)	1.472	0.276	7.857	0.684
		Type II	182(65.7)	90(62.1)	1.236	0.235	6.496	
		others	5(1.8)	2(1.4)				
5	Medication adherence	yes	264(95.3)	142(97.9)	2.331	0.653	8.315	0.192
		no	13(4.7)	3(2.1)				
6	Medication intake	Insulin	115(41.5)	60(41.4)	1.006	0.669	1.512	0.978
		oral	162(58.5)	85(58.6)				
7	Blood glucose Check- up	never	22(7.9)	7(4.8)	0.376	0.147	0.963	0.031
		once	19(6.9)	12(8.3)	0.746	0.327	1.706	
		sometimes	121(43.7)	46(31.7)	0.449	0.266	0.760	
		mostly	63 (22.7)	36 (24.8)	0.675	0.381	1.198	
		always	277(65.6)	145(34.4)				
8	Blood glucose level	FBS Between 60-140mg/dl	118(42.6)	14(9.7)	0.144	0.079	0.262	.000
		FBS >= 140mg/dl	159(57.4)	131(90.3)				

From the total of 19 variables studied under this study; only dietary practice, presence of complication and having FBS >= 140 were found to be independently associated with treatment outcome (See Table 7).

Table 7

Independent predictors predicting treatment outcome among the respondents at selected hospitals of southern Ethiopia, 2021 (n=422).

Variables	Category	COR :95% C.I. for			AOR 95% C.I. for		
		EXP(B)	Lower	Upper	EXP(B)	Lower	Upper
Dietary practice	Good	1.317	0.877	1.97	0.924	0.869	0.983
	Poor						
Presence of complication	yes						
	No	0.967	0.638	1.466	0.425	0.217	.832
FBS	60-140mg/dl						
	>= 140 mg/dl	0.144	0.079	0.262	0.080	0.034	0.188

Discussion

According to this study from the total sample size of 422 participants; 277 (65.6%) were found to be good treatment outcome; Whereas 145 (34.4%) were found to be poor treatment outcome. But it is lower than different studies done in debretabor in Ethiopia, (71.4%) (8); Dessie Referral Hospital (70.8%) (9); Jimma University Teaching Hospital (70.9%) (10). This might be due to difference in measurement scale, improved patient treatment outcome and studies done in different health setting in southern Ethiopia.

This study also showed that those participants who do not adhered to the recommended dietary practice had 7.6 % times AOR; 0.924; 95% (0.869, 0.983) more developed poor treatment outcome compared to those who adhered to dietary practice. So, this study revealed that adherence to dietary recommendation had significant associated with glycemic control among diabetes patients. This study result is consistent with the study done in Gulf Cooperation Council Countries (11) and turkey (12) demonstrated that poor compliance to diet control is significantly associated with poor glycemic control. It is also found to be associated independently according to the study done in debretabor in Ethiopia (8).

It is obvious that lifestyle modifications, such as compliance to the recommended diet, are very important strategies for controlling patients' blood sugar. Thus, poor adherence to a recommended diet might make it more difficult to control blood sugar.

This study also showed that those participants who have complication were found to be 57.5 % times AOR; 0.425; 95% (0.217, 0.832) develop poor treatment outcome when compared with that of who had not complication.

Other studies done in south west tertiary hospitals (14) and Gondar hospital (13) in Ethiopia respectively indicated that having complication were strongly associated with poor glycaemic outcome. Other studies at mult selected public hospitals of western Ethiopia (14) also revealed that there is strong association of presence of complication with poor glycemic control.

This study also indicated that those participants who had FBS ≥ 140 mg/dl were found to be 8 % times AOR; 0.080; 95% (0.034,0.188) times developed poor treatment outcome when compared with that of who had FBS between 60 and 140mg/dl. It is generally accepted truth that as an individual FBS had increased the more individuals have a probability to develop poor treatment outcome.

Conclusion

According to this study; the magnitude of treatment outcome were found to be low. The study also revealed that dietary practice, presence of complication and having FBS greater than 140mg/dl were found to be predicting independently.

Recommendation

Since the magnitude of treatment outcome were found to be low, the health care providers together with the responsible bodies should strengthen to provide toward improvement of factors affecting the patients by inhibiting them not to be in a state of good treatment.

LIMITATION

There might be recall bias in the past 7 days while the participants have responding to assess medication adherence.

Acronyms And Abbreviation

CBE: Community based education

DM: Diabetes mellitus

HUCSH: Hawassa University Comprehensive Specialized Hospital

WHO: World health organization

Declarations

Ethics approval and consent to participate

After the ethical review committee of hawassa University College of medicine and health science have approved; the study was employed. Then after promising confidentiality written informed consent was got from each study participant in order to proceed in the study. An individual who was unenthusiastic to join in the study was allowed to take out. We also assure that there was no danger that put the participant putting the participants at hurt.

Consent for publication

We all reach to consensus for publication. I am a corresponding author and first author of this finding.

Consent to publish

The consent form is held by the authors. Written informed consent was obtained from the participant.

Availability of data and materials

The study finding was putted in public repositories. So that the readers can access the data with the following cite called <https://www.hindawi.com/research.data/#statement>. So that the readers can access the soft copy of this manuscript as supplementary file.

Competing interests

There is no opposing interest.

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No funding is required. To do this research the researcher did not receive any specific funding and performed as part authors intended to do so by their own intention to do research in the university hospital. It was mainly based on their past experience that we have in the hospital with in the university. Since there is no funder to do this research there is no conflict of interest. We also ask free publication fee since we both authors are living in the developing sub Saharan African country called Ethiopia.

Author's contribution

The author contributes in conception and design, acquisition of data or analysis and interpretation of data. They also take part in drafting article or revising and approval of the manuscript before it have been published with accountability of the work done in the manuscript

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References

1. A.S.Fauci,D.L.Kasper,D.L.Longoetal.,Harrison's:Principles of Internal Medicine, McGraw-Hill, New York, NY, USA, 17th edition, 2008.
2. International Diabetes Federation. Diabetes Atlas. IDF. 7th edn. 2015. American Diabetes Association. Standards of Medical Care in diabetes. Diabetes Care. 2015;38(Suppl. 1)

3. World Health organization. Screening for Type 2 Diabetes. 2004;27(Suppl.) Available from: http://www.who.int/diabetes/publications/en/screening_mnc03.pdf accessed on July 5, 2016.
4. World Health Organization, "Diabetes fact sheet No 312," 2015, <http://www.who.int/mediacentre/factsheets/fs312/en>.
5. American Diabetes Association. Standards of Medical Care in diabetes. Diabetes Care. 2015;38(Suppl. (7))
6. M. von Korff, W. Katon, E. H. B. Lin et al., "Potentially modifiable factors associated with disability among people with diabetes," Psychosomatic Medicine, vol. 67, no. 2, pp. 233–240, 2005
7. Litwak L, Goh SY, Hussein Z, Malek R, Prusty V, et al. (2013) Prevalence of diabetes complications in people with type 2 diabetes mellitus and its association with baseline characteristics in the multinational study. Diabetol Metab Syndr 5: 57.
8. Kassahun T, Eshetie T, Gesesew H. Factors associated with glycemic control among adult patient with type 2 diabetes mellitus; a cross – sectional study done in Ethiopia. BMC Res Notes. Bio Med Central 2016;9(1);78
9. Fiseha T, Alemayehu E, Kassahun W, Adamu A, Gebreweld A. Factors associated with glycemic control among diabetic adult out-patients in Northeast Ethiopia [Internet]. BioMed Central BMC Res Notes 2018;11(316):4e9, <https://doi.org/10.1186/s13104-018-3423-5>
10. Alramadan MJ, Afroz A, Hussain SM, et al. Patient related determinants of glycaemic control in people with type 2 diabetes in the Gulf Cooperation Council Countries: a systematic review. J Diabetes Res. 2018;2018:9389265.
11. Kayar Y, Ilhan A, Kayar NB, et al. Relationship between the poor glycemic control and risk factors, life style and complications. Biomed Res India. 2017;28(4):1581–6.
12. Gebre BB, Assefa ZM. Magnitude and associated factors of diabetic complication among diabetic patients attending Gurage zone hospitals, South West Ethiopia. BMC Res Notes. 2019;12(1):780. doi:10.1186/s13104-019-4808-9
13. Fasil A, Biadgo B, Abebe M. Glycemic control and diabetes complications among diabetes mellitus patients attending at University of Gondar Hospital, Northwest Ethiopia. Diabetes Metab Syndr Obes. 2019;12:75. doi:10.2147/DMSO.S185614
14. Oluma A, Abadiga M, Mosisa G, Etafa W (2021) Magnitude and predictors of poor glycemic control among patients with diabetes attending public hospitals of Western Ethiopia. PLoS ONE 16(2): e0247634. <https://doi.org/10.1371/journal.pone.0247634>
15. <https://www.researchsquare.com/article/rs-917406/v1>