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Clinical observation of patients with fractures of the proximal humerus bone in Kazakhstan

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Editorial

Two decades of health workforce development planning: What do we learn/miss

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Ethiopia has made significant strides in expanding its Primary Health Care Units (PHCUs) by upgrading existing facilities and constructing new ones. While there has been progress in increasing access to healthcare services in the decade leading up to 2015, several health indicators remain suboptimal, highlighting the need for both improved coverage and service quality [1].

At the heart of these healthcare challenges lies the issue of human resources for health (HRH). The provision of accessible, affordable, effective, safe, and patient-centered quality health services depends on having a sufficient, motivated, and appropriately skilled healthcare workforce working within service delivery models that enhance their performance [2]. Globally, one of the main barriers to healthcare service access is the shortage of properly trained healthcare workers [3]. During the Millennium Development Goals era, the country had one physician to a population of 42,000 and one midwife to 57,000 and an overall ratio of 0.3 health workforce (HWF) for 1,000 people. The figures were indications that Ethiopia was in the worst crises even compare to the average for sub-Saharan African countries [4].

Recognizing the need to improve public sector services and utilize resources optimally, the Federal Ministry of Health (FMoH) introduced Business Process Reengineering (BPR) as a tool for streamlining work processes and systems [5]. The health sector's Human Resource Development Framework (2006-2010) and subsequent HRH Strategic Plans (2010-2015 and 2016-2025) were developed to address the identified challenges in HRH, respond to reform agendas, and improve health outcomes in alignment with national and global priorities [6,7].

In the HSDP IV (2010/11 – 2014/15), improving human capacity and governance was one of the key strategic objectives. The plan aimed to achieve a positive balance between the production and loss of health staff to attain the right numbers and skills mix of health workers. Efforts were made to improve the availability of key HRH categories, focusing on scaling up pre-service training for professionals in scarce supply, including medical doctors, Integrated Emergency Surgical Officers (IESOs), anaesthesia providers, and midwives. Initiatives such as the accelerated midwifery program and the expansion of medical education programs were undertaken [9].

By 2015 those human resource development initiatives resulted in improvement of HWF density from 0.3 to 0.7 per thousand population. However, this significant expansion in specific categories of health professionals came at the cost of closing some programs and a significant decrease in enrolment numbers, especially for pharmacy, laboratory, environmental health, and health education. A trend analysis report depicted in the table below from the Human Resource Development and Administration Directorate at the FMoH in 2015 revealed the number of graduates (BSc) of health professionals from public institutions for five consecutive years.

Table 1: Trend of number of health professionals graduated from public universities from 2020/11-2014/15.

Professional category	2010/11	2011/12	2012/13	2013/14	2014/15	Total
Health officers	850	890	1234	1492	1439	5905
Physicians	345	447	481	833	1316	3481
Nurses	1020	911	1100	1043	1375	5449
Midwife	320	321	347	397	548	1933
Pharmacist	451	420	415	400	377	2063
Medical Lab Technologist	160	152	141	145	143	741

The analysis also predicted that if the preservice education continues with the same output, the country will face a critical deficit of over 11,291 pharmacists and laboratory technologists by 2020 to meet the minimum standard of existing healthcare service demand, plus the saturation of civil service hiring capacity for medical doctors in less than 3 years. In 2015, the regional health bureaus have already stopped hiring health officers deployed from the center. Hence, the FMOH presented the findings of the analysis to the Ministry of Education, recommending an improvement in the enrolment of laboratory technologists and pharmacists while reducing the enrolment of medical doctors by half and focusing on improvement of quality of medical education.

Since 2014, regional health bureaus have expressed deep concerns about the critical shortage of allied health workers, particularly laboratory professionals and pharmacists. For example, in the 2016/2017 graduation year, the Ministry has deployed 2170 medical doctors, 1199 health officers, 1087 nurses, 1091 midwives, but only 450 pharmacist, 165 laboratory technologist and 96 anesthesia.

Fast forward in 2022, the country reported 14,587 physicians in the public sector, 70,246 nurses and 21,993 midwives, reaching the WHO minimum standards for both medical doctor and nurses. Despite these the HWF density is only 2.2 per 1,000 population (below the WHO set target) and Ethiopia still has the lowest HWF density compared to the African region [11].

The paradox is that, with the existing Ethiopian health facility human resource staffing standard, the civil service sector has saturated its capacity to hire health professionals. And in the last 5 years the failure to deploy health professionals centrally has resulted in uncertainty for employment of graduates, dissatisfaction with the regional hiring procedures, exposing the HRH to injustice, unemployment, and ethnic politics.

In conclusion, despite significant expansion in the development of the health workforce, particularly since 2009 and the introduction of licencing examination as quality control, there is a growing concern of the imbalance on skill mix and employability of essential health professionals. The consequences of this oversight are already being felt, with a critical shortage of certain allied health professionals, graduate unemployment, and exposure of graduates to regional politics and abuse. The healthcare system appears to be leaning heavily toward an oversupply of physicians compared to the available civil service positions, further compounding the skill mix imbalance. Addressing these issues will be crucial for sustaining and improving Ethiopia's healthcare services.

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Original Article

Dietary practice and its association with glycemic control among individuals with type 2 diabetes mellitus in Ethiopia: A multi-center cross-sectional study

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Abstract

Background: Type 2 Diabetes Mellitus (T2DM) is a chronic metabolic disorder that needs a comprehensive management plan. The integral role of nutrition therapy in diabetes management is getting special attention in guidelines though the practice is in a primitive stage, especially in resource limited settings where lifestyle modifications have a large role in the overburdened healthcare system. Understanding the current dietary practice and its effect on disease control in settings where a tertiary level care is provided is a critical step in providing targeted intervention. Therefore, the aim of the study was to assess dietary practice and its association with level of glycemic control among individuals with T2DM who were on follow-up at two large tertiary hospitals in Ethiopia.

Methods: A hospital based cross-sectional study was conducted from January to March 2023 among 314 systematically selected individuals with T2DM who were on follow-up at diabetes clinics of St. Paul's Hospital Millennium Medical College and Tikur Anbessa Specialized Hospital. Data was collected using a pre-tested structured questionnaire and summarized using frequency and median (interquartile range). To examine the association of dietary practice with level of glycemic control, a binary logistic regression model was run at 5% level of significance where Adjusted Odds Ratio (AOR) and 95% CI for AOR were used to interpret the results.

Results: From the 314 participants, 146 (46.5%) patients had adequate knowledge regarding the recommended dietary practices and only 42 (13.4%) of the individuals practiced a healthy diet. A total of 107 (34.1%, 95% CI=29.0%-39.2%) had optimal glycemic control. Poor dietary practice (AOR=7.93, 95% CI=2.63-23.89, $p<0.001$), obesity (AOR=2.74, 95% CI=1.05-7.18%, $p=0.04$), and taking combination oral anti-diabetic drugs (AOR=6.22, 95% CI=3.05-12.69, $p<0.001$) were significantly associated with suboptimal glycemic control.

Conclusions: Dietary knowledge and practice among individuals with T2DM were very low, as is the level of glycemic control, which are similar to studies conducted years back, indicating a lack of improvement in the desired behavior over time. Poor dietary practice in turn was associated with suboptimal glycemic control. It is important to target interventions that enhance the understanding and application of dietary practice in these individuals.

Keywords: Type 2 Diabetes Mellitus, Dietary Knowledge, Dietary Practice, Glycemic control, Fasting Blood Sugar, Ethiopia

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Background

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder characterized by hyperglycemia caused by the body's failure to produce or utilize insulin adequately (1). The global prevalence of T2DM has risen in recent years, with an estimated 537 million adults living with the disease by 2021. Africa has the fastest growing prevalence of T2DM, with 24 million people living with the disease in 2021, and the figure is predicted to rise to 55 million by 2045, the largest growth of any International Diabetes Federation (IDF) region. In Ethiopia, 1.9 million people were estimated to live with the disease in the year 2021 (2).

Without early diagnosis and management, T2DM can lead to serious long-term complications including cardiovascular disease, stroke, chronic kidney disease, damage to the nerve, leg ulcer, and increased risk of death (2,3). The combination of rise in incidence, morbidity and mortality rates related to diabetes presents a big challenge to the health-care system and lowers the standard of life of those affected (4). Therefore, achieving optimal glycemic control is vital (1-2,5). However, despite the growing attention given to the management of chronic medical illness, including diabetes, and the numerous interventions designed to help individuals achieve their treatment goals and live a quality life, the vast majority of these people have suboptimal glycemic control. This is true for both developing and developed nations, with multiple studies revealing inadequate glycemic control in up to three-quarters of patients (6-10).

To achieve optimal glycemic control, a comprehensive management plan that includes dietary changes, exercise, and weight loss in addition to standard pharmacological therapy is required (1-2,5). Dietary management is one component of the management that should be followed over long term and is expected to lower hemoglobin A1C levels by 1%-2%, thereby preventing or delaying micro and macro-vascular complications. Despite the existence of published standards for optimum diabetes treatment, evidence suggests that translating nutrition guidelines into daily routine can be challenging for the majority of people with diabetes (5,11). Numerous researches have also found that 50-80% of the studied population had poor dietary practices and also knowledge of the recommended dietary practices (12-19). The lack of adherence to the recommended dietary practice, in turn, is directly associated with an increased risk of suboptimal glycemic control. It has been reported that those with poor dietary habits have a fivefold increased risk of having suboptimal glycemic control, necessitating the escalation of pharmacologic treatment and thus increasing the risk of disease complication and drug side effects on the patient (19-22).

In resource-constrained countries such as Ethiopia, the cost of healthcare is often high, necessitating a significant emphasis on preventive aspects of disease management such as lifestyle modifications, as caring

for those with complications can be costly or unavailable, resulting in poor quality of life and an increased risk of mortality. As a result, understanding the current practice and its effect on disease control in settings where a tertiary level care is provided and where dietary practice is expected to be better is crucial to understanding the current disparity in these people's dietary habits and hence is a critical step in providing targeted intervention. Therefore, the aim of this study was to assess the dietary practice of individuals with T2DM and its association with level of glycemic control among those who were on follow-up at two large tertiary hospitals in Ethiopia.

Methods and Materials

Study Design and Setting

A hospital based Cross-sectional study was conducted from January to March, 2023 at the two largest tertiary hospitals in Ethiopia; St. Paul's hospital millennium medical college (SPHMMC) and Tikur Anbessa Specialized Hospital (TASH) which are located in Addis Ababa, the capital city of Ethiopia. Both hospitals have endocrine clinics where patients are followed by internal medicine residents, internists and/or fellow and senior endocrinologists. The majority of patients in these clinics are diabetic, accounting for 80-90% of total patients attending the endocrine outpatient department, and an average of 360 diabetic patients per month at SPHMMC and 120 patients per month at TASH were seen in the three months preceding the study.

Population and Eligibility

The study included non-pregnant adults with a confirmed diagnosis of T2DM who were on follow-up at the endocrine clinics of the hospitals from January to March 2023, had been on follow-up for at least six months, and were in stable medical condition at the time of the study.

Sample Size Determination and Sampling Procedure

Sample size for the descriptive objective of the study (to determine the level of glycemic control) was calculated by using single population proportion formula by taking proportion of suboptimal glycemic control as 72%, 5% level of significance, 5% margin of error and the calculated sample size was 310. And sample size for the inferential objective (association of dietary habit with glycemic control) was calculated using double population proportion formula with the following assumptions; 95% confidence interval, power of 80%, the proportion of individuals with T2DM with good dietary habit who had suboptimal glycemic control as 32%, proportion of individuals with T2DM with bad dietary habit who had suboptimal glycemic control as 68%, and a non-response rate of 10% and the calculated sample size was 70 (10). By taking the largest sample size from the two and adjusting for non-response rate of 10%, the final sample size was 341. This was then proportionally allocated to the two hospitals; (257 from SPHMMC and 84 from TASH). To select the

study participants, a systematic random sampling method using the k^{th} interval of 2 was employed.

Operational Definitions

Glycemic control: According to American Diabetes Association (ADA) criteria, optimal glycemic control is defined as a three-month average fasting blood sugar of 80-130 mg/dl. Any result out of this range signifies suboptimal glycemic control (23).

Dietary practice: Practice was assessed using 12 questions and the total response was classified in to three groups based on the modified Bloom's cut-off point as good (80-100%), moderate (60-79.9%) and poor (<60%) practice (9,10,14,19,24)

Dietary knowledge: Knowledge was assessed using eight questions and the total response was classified in to three groups based on the modified Bloom's cut-off point as adequate (80-100%), moderate (60-79.9%) and inadequate (<60%) knowledge (9,10,14,19,24).

Physical activity: According to ADA recommendation on physical activity for individual with diabetes, it is classified as (23);

Optimal (Moderate/ vigorous) activity: Prolonged, rhythmic activity using large muscle groups (e.g., walking, cycling and swimming), at least 150 min/week, 3-7 days/ weeks

Sub-optimal: Any activity less than what is stated above.

Data Collection and Quality Assurance

A pre-tested structured interviewer administered questionnaire was used to collect data on sociodemographic, clinical characteristics, dietary knowledge and practice, and glycemic control level of the participants. Data was collected by four trained General practitioners who were working at chronic follow-up clinics of the hospitals.

Dietary Knowledge was assessed using eight questions that were adopted from other literature and contextualized into the local context. Each question was answered using the "Yes", "No" and "I don't know" options. A correct answer ("Yes") was assigned 1 point and an incorrect/unknown answer ("No" and "I don't know") were assigned 0 points. The total score for each patient on the eight questions was calculated and changed to percentage. After that the score of each participant was changed into a three-category response based on modified Bloom's cut-off point, as adequate (if score was between 80 and 100%), moderate (if the score was between 60 and 79.9%), and inadequate (if the score was less than 60%) knowledge. Dietary practice was assessed using 12 questions with two response categories ("Yes" and "No"), where those who answered "Yes" were given a score of 1 and those who answered "No" were given

a score of 0. The total score for *each patient on the 12 items* was calculated and changed to percentage. Then, modified Bloom's cut-off point was used to categorize the response as good (80-100%), moderate (60-79.9%) and poor (<60%) practice.

Weight and height were measured by the data collectors by following the proper methods of measurements. The body mass index (BMI) of each participant was then calculated using the formula: $BMI = \text{weight (kg)} / \text{height (m}^2\text{)}$ and participants were classified according to the WHO International classification of adult weight. Finally, the three months average FBS was calculated for each patient from the results attached on their chart.

Statistical Analysis

The characteristics of the participants were presented using frequency with percentages for categorical variables. For numeric variables, median (with interquartile range) was used due to the skewed distribution of the numeric data, as evidenced by a significant result on the Kolmogorov-Smirnov test of normality (p-value <0.0001).

To examine the association of dietary practice and the other factors with glycemic control, a binary logistic regression model was used. At a p-value of <0.25, a univariate analysis was run to assess the relationship of each factor with level of glycemic control. Variables with significant association were then fitted into the final multivariable model where Adjusted Odds ratio (AOR) and 95% confidence interval for AOR were used to interpret significant results at a p-value of <0.05. The final model's adequacy was tested using Hosmer and Lemeshow test, and the result showed that the data fitted the model very well ($X^2_{(8)} = 6.67$ and p-value=0.573). All data management and analysis were done using SPSS software Version 25.0.

Results

Socio-demographic Characteristics

Out of the total of 341 participants, 314 completed the interview and were included in the analysis, making a response rate of 92.1%. The median age of the participants was 56.0 years (IQR, 50.0-64) with the majority being older than 40 years, with most 50-59 years old (35.0%). The study included a nearly equal proportion of males (50.3%) and females (49.7%). Only 26 (8.3%) of the participants were unable to read or write; the remainder have formal schooling experience ranging from primary to master's level. The majority (61.8%) were followers of Orthodox Christian religion. Over a third (71.3%) were from Addis Ababa, while 71 (22.6%) were residents of the Oromia region. (**Table 1**)

Table 1: Socio-demographic characteristics of individuals with T2DM on follow up at two tertiary hospitals Ethiopia, 2023 (n=314)

Variable		Fre- quency	Per- centage
Age cate- gory (in years)	22-39	10	3.2
	40-49	64	20.4
	50-59	110	35.0
	60-69	87	27.7
	70-82	43	13.7
Sex	Male	158	50.3
	Female	156	49.7
Marital status	Single	8	2.5
	Married	239	76.1
	Divorced	22	7.0
	Widowed	45	14.3
Education- al level	Cannot read and write	26	8.3
	Primary	143	45.5
	Second- ary	57	18.2
	Diploma and above	88	28.0
Religion	Orthodox	194	61.8
	Muslim	73	23.2
	Protestan t	46	14.6
Place of residence	Catholic	1	0.3
	Addis Ababa	224	71.3
	Oromia	71	22.6
	Others ^a	21	6.7

^a Amhara, SNNP, Dire Dawa, Afar, and Sidama

Behavioral and Clinical Characteristics

One or more comorbid illnesses were diagnosed in 277 (88.2%) patients, with hypertension accounting for 246 (78.3%) cases, followed by neurologic conditions in 126 (40.1%), renal condition in 69 (22.0%), cardiac disease in 47 (15.0%), and dyslipidemia in 29 (9.2%). At the time of the study, almost three-quarters were above normal weight; 135 (43.0%) were overweight and 83 (26.4%) were obese. Two hundred forty-six (78.3%) participants claimed to exercise sub-optimally. Twelve (3.8%) were smokers, and 49 (15.6%) chewed Khat.

The median disease duration following T2DM diagnosis was 8.6 years (IQR, 6.0-11.0 years), and nearly half of the patients (49.7%) had diabetes for 6-10 years. At the time of the study, all of the participants were taking oral anti-diabetic medication; 32 (10.2%) were taking Glibenclamide, 80 (25.5%) were taking Metformin, and the remaining 202 (64.3%) were taking both prescriptions. (Table 2)

Table 2: Behavioral and clinical characteristics of individuals with T2DM on follow up at two tertiary hospitals in Ethiopia, 2023 (n=314)

Variable		Fre- quency	Per- centage
Comorbid illness	No	37	11.8
	Yes	277	88.2
Hyperten- sion	No	68	21.7
	Yes	246	78.3
Dyslipidem- ia	No	285	90.8
	Yes	29	9.2
Cardiac	No	267	85.0
	Yes	47	15.0
Neurology	No	188	59.9
	Yes	126	40.1
Renal	No	245	78.0
	Yes	69	22.0
Asthma	No	299	95.2
	Yes	15	4.8
HI	No	301	95.9
	Yes	13	4.1
BMI Cate- gory	Under- weight	7	2.2
	Healthy weight	89	28.3
	Over- weight	135	43.0
Exercise	Obese	83	26.4
	Moderate/ vigorous	68	21.7
	Sub- optimal	246	78.3
Smoking	No	302	96.2
	Yes	12	3.8
Khat chew- ing	No	265	84.4
	Yes	49	15.6
Disease du- ration (in years)	1-5	69	22.0
	6-10	156	49.7
	≥ 11	89	28.3
Medication type	Metfor- min	80	25.5
	Glibencla mide	32	10.2
	Met- formin/ Glibencla mide	202	64.3

Dietary knowledge

A total of 146 (46.5%) patients had adequate knowledge regarding the recommended dietary practices for individuals with T2DM, 91 (29.0%) had moderate knowledge, and the remaining 77 (24.5%) had inadequate knowledge.

Three hundred four people (96.8%) were aware that nutrition is crucial in diabetes control. When it came to choosing a proper diet to control blood glucose, 227 (72.3%), 221 (70.4%), 226 (72.0%), 270 (86.0%), and 204 (65.5%) were aware of the importance of eating fruits and vegetables, reducing high fat diet, reducing fried food consumption, mini-

glycemic control was assessed using a binary logistic regression model. From the univariate analysis, age group, gender, educational level, hypertension, heart illness, neurologic disorders, renal disease, BMI, exercise, treatment regimen, and dietary practice were all found to be significant. Then multivariable analysis was then run using these variables.

Table 3: Dietary knowledge of individuals with T2DM on follow up at two tertiary hospitals in Ethiopia, 2023 (n=314)

Variable	Yes (%)	IDK (%)	No (%)
Nutrition plays an important role in diabetes management	304 (96.8)	8 (2.5)	2 (0.6)
Fruits and vegetables must be eaten because they are good for managing blood sugar	227 (72.3)	77 (24.5)	10 (3.2)
High-fat dairy products, including those high in animal proteins, must be avoided	221 (70.4)	37 (11.8)	56 (17.8)
Fried food and other foods high in fat must be avoided	226 (72.0)	67 (21.3)	21 (6.7)
It is good to cut back on salty foods, including high-sodium foods such as processed food	270 (86.0)	18 (5.7)	26 (8.2)
It is good to cut back on sugary food	204 (65.5)	98 (31.2)	12 (3.8)
It is good to eat small, frequent meals regularly to manage blood sugar	197 (62.7)	100 (31.8)	17 (5.4)
Eating a large portion of food at once may lead to increased blood sugar	206 (65.6)	66 (21.0)	42 (13.4)

Dietary practice

Only 42 (13.4%) of the individuals practiced a healthy diet. Sixty-eight (21.7%) had moderate practice and 204 (65.0%) had poor practice.

Eighty-nine (28.3%) had a meal plan and 178 (56.7%) had skipped either lunch or supper within a week of the interview. In terms of daily consumption of nutritious foods, 180 (57.3%) claimed to eat vegetables, 198 (63.1%) eat fruits, and 247 (78.7%) eat fiber rich foods on a daily basis. With regard to avoiding glucose-inducing foods, decreased consumption of carbohydrate-rich foods, salty foods, sugary foods or drinks, and fried foods was practiced by 101 (32.2%), 173 (55.1%), 187 (59.6%), and 89 (28.3%), respectively. The majority (83.3%) do not consume alcohol. One hundred twenty-three (39.2%) had a meal frequency of three meals with two or three snacks, and 279 (88.9%) consumed small to average portions. (Table 4)

Glycemic Control

From the 314 participants, 107 (34.1%, 95% CI= 29.0%-39.2%) had optimal glycemic control and the rest 207 (65.9%, 95% CI= 60.8%-71.0%) had suboptimal glycemic control.

Factors associated with level of glycemic control

The association of dietary practice and other socio-demographic and clinical characteristics with level of

Accordingly, after controlling for all the confounders in the model, dietary practice was found to be significantly associated with level of glycemic control. The odds of having suboptimal glycemic control among patients with poor dietary practice was 7.93 times higher as compared to those with good dietary practice (AOR=7.93, 95% CI= 2.63-23.89, p<0.001). On the other hand, a significant difference in glycemic control level was not observed between those with moderate and good glycemic control.

Furthermore, BMI and treatment regimen were also found to have a significant association with level of glycemic control. Patients with BMI of 30 and above had an increased odds of having suboptimal glycemic control by 2.74 times than patients with BMI of less than 25 (AOR=2.74, 95% CI= 1.05-7.18%, p=0.04). Patients taking combination oral anti-diabetic medications (Metformin and Glibenclamide) had 6.22 times increased odds of having suboptimal glycemic control than those taking a single oral anti-diabetic medication of either type (AOR=6.22, 95% CI= 3.05-12.69, p<0.001). (Table 5)

Table 4: Dietary practice of individuals with T2DM on follow up at two tertiary hospitals in Ethiopia, 2023

Variable		Frequency	Percentage
Do you have a current meal plan?	No	225	71.7
	Yes	89	28.3
In the past week, were there any days when you skipped lunch or supper?	No	136	43.3
	Yes	178	56.7
Do you eat vegetables daily?	No	134	42.7
	Yes	180	57.3
Do you eat fruit daily?	No	198	63.1
	Yes	116	36.9
Do you often eat fiber-rich foods like beans, lentils, legumes, and whole grain foods, among others?	No	67	21.3
	Yes	247	78.7
Do you often eat carbohydrate-rich foods?	No	101	32.2
	Yes	213	67.8
Do you eat salty food?	No	173	55.1
	Yes	141	44.9
Do you consume sugary foods or beverages?	No	187	59.6
	Yes	127	40.4
Do you often eat fried food and fat?	No	89	28.3
	Yes	225	71.7
Do you drink alcohol?	No	263	83.8
	Yes	51	16.2
Meal and snack frequency	3 meals with 2-3 snacks	123	39.2
	Less/more frequent	191	60.8
Food portion	Small/Average	279	88.9
	Large	35	11.1

Discussion

In this study, we have assessed dietary practice of individuals with T2DM and its association with glycemic control among patients on follow-up at diabetes clinics of two tertiary hospitals in Ethiopia. The study included 314 participants with a median age of 56 years.

The result of this study showed that the majority of individuals with T2DM had either moderate (29.0%) or inadequate (24.5%) knowledge about the recommended dietary practices for their condition. While almost all (96.8%) were aware of the general importance of nutritional intervention in diabetes control, two-thirds were not aware of the specific dietary recommendations. This low level of knowledge could be attributed to inadequate education from their healthcare providers or limited access to additional credible information sources that are prepared in local

languages. Furthermore, the dietary practice of the study participants showed that only 42 (13.4%) practiced a healthy diet and 68 (21.7%) had moderate practice. More than three-quarters did not have a meal plan, and more than half did not adhere to the suggested dietary practices. This is also true among individuals who indicated moderate to adequate comprehension of the recommended practice. Despite the fact that most have been living with the disease for an average of 8.6 years, the lower level of knowledge and practice is concerning, especially given that the majority have additional comorbid illnesses that necessitate extra caution in dietary measures as it can result in suboptimal glycemic control, an increased risk of complications, and thus a lower quality of life and increased mortality. Previous studies in similar settings have also shown comparable findings in both knowledge and practice, implying a possible inadequate intervention over time in bringing people to a desirable behavior (15, 25-26).

Table 5: Factors associated with level of glycemic control among individuals with T2DM on follow up at two tertiary hospitals in Ethiopia, 2023 (n=314)

Variable	Glycemic control		COR (95% CI)	AOR (95% CI)	p-value	
	Optimal	Sub-optimal				
Age category (in years)	22-49	39	35	1	1	0.802
	50-59	44	66	1.67 (0.92-3.03)	1.11 (0.49-2.53)	
	60-69	16	71	4.95 (2.43-10.04)	2.28 (0.87-5.96)	
	70-82	8	35	4.88 (1.99-11.91)	1.32 (0.36-4.87)	
Sex	Male	60	98	1	1	0.952
	Female	47	109	1.42 (0.89-2.27)	1.02 (0.48-2.19)	
Educational level	Cannot read and write	7	19	1	1	0.149
	Primary	34	109	1.18 (0.46-3.05)	2.38 (0.73-7.71)	
	Secondary	21	36	0.63 (0.23-1.75)	2.52 (0.65-9.84)	
	Diploma and above	45	43	0.35 (0.14-0.92)	1.96 (0.49-7.89)	
Hypertension	No	33	35	1	1	0.202
	Yes	74	172	2.19 (1.27-3.79)	0.58 (0.26-1.33)	
Cardiac disease	No	100	167	1	1	0.377
	Yes	7	40	3.42 (1.48-7.93)	1.58 (0.57-4.38)	
Neurologic conditions	No	75	113	1	1	0.458
	Yes	32	94	1.95 (1.19-3.20)	0.76 (0.37-1.56)	
Renal	No	95	150	1	1	0.617
	Yes	12	57	3.01 (1.53-5.89)	1.26 (0.51-3.07)	
BMI	<25.0	52	44	1	1	0.659
	25.0-29.9	42	93	2.62 (1.52-4.50)	1.19 (0.55-2.56)	
	≥ 30	13	70	6.36 (3.11-13.01)	2.74 (1.05-7.18)	
Exercise	Moderate/vigorous	46	22	1	1	0.040*
	Sub-optimal	61	185	6.34 (3.53-11.38)	1.57 (0.62-3.95)	
Treatment regimen	Glibenclamide/Metformin	77	35	1	1	<0.001*
	Glibenclamide and Metformin	30	172	12.61 (7.23-22.01)	6.22 (3.05-12.69)	
Dietary practice	Good	35	169	1	1	0.079
	Moderate	37	31	4.19 (1.63-10.74)	2.65 (0.89-7.84)	
	Poor	35	7	24.14 (9.92-58.75)	7.93 (2.63-23.89)	

* Statistically Significant at P<0.05, AOR (Adjusted Odds Ratio), COR (Crude Odds Ratio)

From the 314 participants, 107 (34.1%) had optimal glycemic control, while the remaining 207 (65.9%) had suboptimal glycemic control. This finding is consistent with previous research conducted in similar setups (8-10). After controlling for potential personal and clinical factors, dietary practice was found to have significant association with glycemic control, with those with poor dietary practice having an almost eight-fold increased odds of having suboptimal glycemic control than those with good dietary practice.

This is a little bit of a magnified risk than previous studies conducted in Ethiopia (21,22). This could be due to the characteristics of the study population in our study where majority had additional risks that could increase the risk of suboptimal glycemic control including old age, one or more additional comorbid illnesses (88%), sub-optimal level of physical activity (78%), being overweight (43%) or obese (26%), smoking (4%) and Khat chewing (16%).

Furthermore, BMI and treatment regimen were also found to have a significant association with level of glycemic control, with obese patients and those on combination therapy having almost three times and six times increased odds of having suboptimal glycemic control, respectively. Obesity is known to be associated with increased insulin resistance in the body, making it challenging to achieve treatment goals even when the patient is on appropriate medication. Additionally, being on combination therapy indicates that the threshold for controlling blood glucose is high, which could be due to different personal and clinical factors interfering with optimal control, as well as the possibility of poor drug adherence with increased pill burden, making glycemic control difficult in these individuals. In previous studies as well, including systematic reviews and meta-analyses, these characteristics have been demonstrated to be associated with suboptimal glycemic control (10, 27-29).

The study was carried out at the country's two main tertiary hospitals, which have a high patient flow and are supposed to deliver the finest available comprehensive management. As a result, the findings of this study enable us to better understand the gap among patients under this type of care and plan accordingly. However, the study did not include additional characteristics such as treatment adherence and other concomitant illness control levels which might contribute to the level of glycemic control in addition to the dietary practice and other factors studied.

Conclusion

The study revealed that dietary knowledge and practice among individuals with T2DM are very low, as is the level of suboptimal glycemic control, which are similar to studies conducted years back, indicating a lack of improvement in the desired behavior over time. Poor dietary practice was significantly associated with suboptimal glycemic control. The findings of this study highlight the importance of targeting interventions that enhance the understanding and application of dietary practice in individuals with T2DM,

including strengthening patient education using culturally sensitive tools and strategies. Furthermore, clinicians should be cautious in the management of patients with the identified significant factors that lead to suboptimal glycemic control.

Declaration

Ethical Considerations: The study was conducted after obtaining ethical clearance from the Ethics Review Committee of St. Paul's Hospital Millennium Medical College and Addis Ababa University College of Health Sciences. Eligible participants patients were given clear information about the purpose of the study and written informed consent was obtained from all. To ensure confidentiality, name and other identifiers of patients were not recorded on the data collection tools. Access to the collected information was limited to the research team and confidentiality was maintained throughout the project.

Availability of data and materials: All relevant data are available upon reasonable request.

Competing interests: The authors declare that they have no known competing interests

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Author's Contribution: FAK conceived and designed the study. TWL, MZM, IAY, BHT, YSS, BST, MFB, and DSW contributed to the conception and design of the study. FAK and TWL performed statistical analysis, and drafted the initial manuscript. MZM, IAY, and BHT contributed to the statistical analysis and interpretation of the findings. YSS, BST, MFB, and DSW revised the manuscript. All authors approved the final version of the manuscript.

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Original Article

Life after stroke: exploring social and psychological consequences of stroke survivors and their caregivers

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Abstract

Aim: To explore the social and psychological consequences of stroke among stroke survivors and their caregivers in Addis Ababa, Ethiopia.

Methods: We conducted in-depth interviews with stroke survivors (n=13) and their caregivers (n=13) in Addis Ababa, Ethiopia. Interviews were conducted in Amharic and were audiotaped. After repeated listening to the records and reading the transcripts, a thematic analysis was conducted.

Results: Six themes emerged: explanatory model, new body, living on a bread line, psychological toll, elephant in the room, and finding a silver lining.

Stroke survivors described stroke as a sudden event that changed their life forever.

Some participants attributed it to the devil's doing, spirit possession (“ልክፍን”) and their sins. Both survivors and their caregivers reported financial crises related to disability, inability to return to work, treatment, and transportation costs. Both survivors and caregivers described the psychological tolls such as emotional ups and downs, anxiety, frustration, sleep problem, and suicidal ideation. Survivors reported distancing themselves from social activities or events whereas; caregivers reported that they did not have enough time to be a part of one. Stroke survivors considered surviving the stroke as a blessing. Caregivers say they have set their minds to be thankful to God that they have their loved ones around despite all the limitations.

Conclusion: Stroke survivors and their caregivers suffer from financial crises and emotional up and downs. This warrants the need for compressive social and psychological interventions in addition to the usual physical care provided for such cases in low-income countries.

Keywords: social, psychological, stroke, caregivers, LMICs

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Background

In Ethiopia, stroke is one of the leading causes of death contributing 1.8% to the Years of Life Lost (YLLs). The statistics increased by a staggering 31% from the year 1990 – 2010 making it into the chart of the leading causes of YLLs (1). Even if the person is lucky and survives, stroke may change the survivors' outlook on life, their ability to participate in daily activities, and their family's financial situation.

The consequences of stroke such as communication and physical disability determine the survivors' ability to return to work. This reduces the quality of life of the stroke survivor and their family for many years post-stroke (2, 3, 4). Returning to work after a stroke

is also associated with improved subjective well-being and life satisfaction (5).

Due to the above consequences most stroke survivors need continuous care from their informal caregivers. The burden on caregivers and the pressure they are under while caring for their loved ones by giving up or putting their own lives on hold is rarely acknowledged (6, 7). They suffer from all the economic, social, and psychological strain that comes along with stroke (8, 9).

However, stroke survivors' and their caregivers life experiences, challenges, and coping practices have not been well explored. In this study, we aimed to get a comprehensive understanding of the after-

math of stroke on survivors and their caregivers in a low-income setting where there is a limited social welfare system and where the epidemiology of stroke is different from high-income countries (10).

Methods

Study design and setting

We conducted a qualitative study to explore the lived experience of stroke survivors and their caregivers. The study was conducted in physiotherapy units of public hospitals in Addis Ababa, Ethiopia. The physiotherapy units provide physical rehabilitation to service users with minor and major disabilities caused by stroke, other health conditions, and accidents. Three to seven physiotherapists with bachelor's and master's degrees in physiotherapy work in each clinic and three of the clinics have physiotherapists with doctorate degrees in physiotherapy. Stroke survivors usually get a minimum of six consecutive therapy sessions and additional unspecified sessions based on the level of disability.

Clinics located on the ground floor of the hospital have a ramp to facilitate access to the unit while those located above the ground floor have elevators to the physiotherapy unit. The units are easily accessible for people who use wheelchairs and canes. All of them have an information desk at the front and one or two offices. All the units have up to ten curtain-sectioned rooms for massage and electrical stimulation sessions. They also have waiting areas for caregivers and family members.

Participants

We employed purposive sampling considering gender, age, time since stroke, and patient health questionnaire (PHQ-9) (11) scores to have a maximum variation in the sample. Stroke survivors with severe aphasia were excluded. A person accompanying a stroke survivor to the physiotherapy unit who lives in the same house, unpaid, and directly implicated in the survivor's care was considered as a caregiver. The number of participants was determined based on theoretical information saturation.

Data collection procedure

We conducted in-depth interviews using an interview guide with probing questions to capture the experience of survivors and caregivers. After the participants finished their physiotherapy session, the physiotherapist linked them with the principal investigator (SS). SS explained the aim of the study and invited them to take part in the study; Written consent was obtained from all participants. All interviews were conducted in a private room.

The interviewer introduced herself, and her role in the research and served kolo (roasted barley) and water, a traditional snack to build rapport and create a welcoming environment. The interviews were audiotaped. The shortest interview took 50 minutes and the longest took 1:30 hrs. The interviews continued

until there was no additional new information obtained. At the end of the interview, participants' feedback on how they felt about the interview was obtained.

Data processing and analysis

All recordings were transcribed in Amharic and translated into English by research assistants and the first author. A thematic analysis approach was used to analyse the data (12). Open Code software V4.03 (13) was used to assist with the analysis.

After repeatedly listening to the audio recordings and reading the transcripts, the primary author (SS) developed initial codes on two transcripts. Then, these initial codes and their descriptions were discussed with another co-author (WF) and came up with a refined framework. The rest of the data were coded according to the agreed codes; with new emerging codes identified throughout the data collection process. After the coding, each code was combined to form themes and sub-themes. Finally, illustrative quotes were used to describe each subtheme.

Data quality measures

A good rapport was built before the interview sessions, and the guide was amended after the first interview. We also tried to involve different types of participants by age, gender, PHQ-9 scores, and duration of the stroke to get different dimensions of survivors and their family's experience after the stroke. We triangulate the experience of stroke survivors' and their caregivers.

Ethical considerations

We obtained ethical clearance from the Institutional Review Board of the College of Health Sciences, Addis Ababa University in 2020 (Psy protocol number=120/20). Written consent was obtained from all participants after the provision of adequate information about the study. Caregivers signed for participants who were unable to write due to their disability with consent from the survivors.

Results

Participant characteristics

We interviewed 26 participants: 13 stroke survivors and 13 caregivers. The stroke survivors' age ranged from 30 to 69 years while caregivers' age ranged from 20 to 83 years. All participants except one, had received formal education. All survivors have hypertension as a comorbidity, and some have diabetes mellitus, cancer, and HIV (Table 1). Ten of the caregivers reported that they spent more than 8 hours a day with survivors giving care as required. Seven of the survivors and five of the caregivers had above 10 scores on PHQ-9 indicating moderate depressive symptoms(14) and they were linked with the psychiatry clinic.

Table 1: Characteristics of stroke survivors and caregivers

No.	Stroke survivors					Caregivers			
	Sex	Age	Duration after stroke in months	Comorbidities	PHQ-9 Score	Sex	Age	Relationship with the survivor	PHQ-9 Score
1	F	30	4	HT	>10	F	41	Sister	>10
2	M	55	13	HT, DM	>10	F	40	Wife	>10
3	M	51	9	HT	<10	M	28	Son	>10
4	M	48	14	HT	>10	F	20	Daughter	<10
5	M	37	6	HT	>10	F	34	Wife	<10
6	M	49	11	HT	<10	F	45	Sister	<10
7	M	61	24	HT, DM	<10	M	31	Son	<10
8	M	48	8	HT	<10	F	37	Wife	<10
9	M	57	144	HT	>10	F	83	Mother	>10
10	M	69	12	HT, DM	<10	F	49	Wife	<10
11	F	51	5	HT, Cancer	>10	F	21	Daughter	>10
12	F	47	24	HT, HIV	<10	M	51	Husband	<10
13	F	38	36	HT, Cardiac	>10	F	35	Relative	<10

DM – Diabetes Mellitus, HT – Hypertension, PHQ-9 – Patient Health Questionaries

Thematic analysis

In the thematic analysis, six themes emerged: explanatory model (perceived cause), new body, living on the bread line, psychological toll, elephant in the room, and finding the silver lining.

Explanatory Model

Participants reported their insight about stroke, the cause of stroke, and their physiotherapy journey. They described stroke as a sudden event that changed their life forever. It was something they were never prepared or ready for. They explained it as an incident without warning and a near-death experience.

“I felt like something hit us like an ocean wave, yesterday we were living a normal life going here and there, he works as a daily labourer, but he was very productive, then you see us today. He cannot lift a finger. It is like death. It did not tell us the date.”

[caregiver_4]

Some participants reported that it was the devil’s doing, other people’s bad wish upon them, and spirit

possession (“ልክፍት”) as the cause of stroke. They also take responsibility for themselves that their sinful act caused the stroke on them or their loved ones.

“The bad spirit got to her when she went to use the toilet, she should not have gone alone since she just gave birth, the bad spirit possessed her. It is

‘ልክፍት’.”
[caregiver_1]

Some have tried different treatment options in addition to the medical treatment including holy water, reading Quran, and taking different herbs. These treatments they have been taking or considering taking were based on the recommendation of family members and friends who were not health professionals.

“There was a lot of advice thrown at us, my mother’s face was distorted right after the stroke and they suggested using “feto” (ፊቶ) to put it in water and drink it as tea, or to put into their face... another one was to use ‘gebto’ (ገብቶ) ... I know we can make liquor out of it but not to lower blood pressure...but we used some of the recommendations ...”

[caregiver_11]

Family members were concerned about the recovery process. They did not know how long it was going to take after the survivors left the hospital and went home. It was very hard for the caregivers and their families to see the survivors suddenly stop what they were doing. Participants' notion about the recovery process was not what they expected, or they did not know what to expect after discharge from the hospital.

New body

Stroke survivors mentioned disability, not feeling like themselves, discomfort with their body and having no control of their body after the stroke which they mentioned as a new body.

Stroke survivors reported facing difficulties to perform daily activities such as feeding themselves, taking baths, walking independently and taking care of their new-born because of the disability after stroke. They reported their inability to move around freely was also dependent on the weather; cold weather forced them to miss even their therapy sessions.

"This thing, the stroke, it does not like cold, it took me more than 20 minutes to get up this morning because it was very cold, it just ties up my hand and leg."
[stroke survivor_10]

A new mom who survived a stroke just 20 days after giving birth described her inability to take care of her newborn as any mother would do. Even years after the stroke, they consider the mobility limitation as a scar and continuous reminder of the powerlessness that is brought upon them by the stroke.

"I am not lucky enough to hold my child, breastfeed her or even help to bathe her; my heart aches when I think of my incapacities...it's sad...I just could not command my hand to ...as I want to..."
[Stroke survivor_1]

Caregivers reported that it took some time to get used to seeing the survivor with new body posture or facial features. They mention how hard it was to see their loved one's physical appearance, activity level change, and difficulty with their speech which they say led them to take over tasks the survivors used to do.

Living on the breadline

Both the survivors and their family members reported financial strain and the struggle for living on the breadline in an aftermath of a stroke. This is related to the disability (inability to work) and added treatment costs (medication, transportation, and related costs). The transportation cost was reported as a big

headache since they may need to take a taxi because public transportation is not conducive for them to take because of their disability.

The disability results in the inability to return to work, prevents them to be employed and forced the survivors to leave on their pensions only. In addition to the stroke survivors' inability to return to work, caregivers also had to give up their jobs for full-time care provision of the survivors. Participants described the difficulties they have to provide sufficient living for their families in many ways.

"... he would at least bring something to eat, as he always did, we both were daily labourers our life was from hand to mouth, he used to wash cars and I worked in people's houses washing clothes or ...; but now he is not working could not even sit up on his own and I have to be here all the time because he does not want anyone else to take care of him, there are days where my children went to sleep in the empty stomach "
[caregiver_5]

Participants also reported another strain they were facing which is the difficulty to send their children to school. They reported that they make their children miss school because they might not have another person to help them to come to the physiotherapy sessions or there might not be enough food at home to provide so they sometimes miss school to do some daily labour to bring home some bread for the other siblings.

".... sometimes I make my older boy miss school so that he would help with putting him into the taxi or the wheelchair; I cannot bring him alone and I do not always get other people around."
[caregiver 2]

Psychological toll

Stroke survivors and caregivers reported emotional up and downs, anxiety, frustration, and psychological problems they face after the stroke. Fear, trauma, sleep problem, anger, and suicidal ideation were also reported.

Both stroke survivors and their family members reported sleep problems. Some reported that they have no sleep at all some nights and usually poor-quality sleep. They reported it as something devastating which leads to fatigue during the day. Some caregivers reported the lack of sleep was because they need to take care of the survivors. They must provide late-night or mid-night medications for the survivors or help them to use the bathroom which causes sleep disturbance and exhaustion during daytime.

“In good nights...when I am lucky, I sleep up to 6 hours but it’s just terrible it’s full of nightmares and the next morning my body feels like I have been running throughout the night; it’s exhausting”
[Caregiver_3]

Caregivers also reported a lack of sleep because they were also taking care of the survivors. On another note, caregivers must provide late-night and midnight medications for the survivors or help them to use the bathroom which causes sleep disturbance and exhaustion during daytime.

“If he is up at night, I would not be able to go to sleep also he will tell me to sit by his side, in the middle of the night ... there were many nights I did not even close my eyes for a bit...he just did not sleep so I have to stay up too”
[caregiver_10]

Participants have also reported serious emotional tolls. The most frequently reported emotional problems were stress, hopelessness, irritability, rapid mood changes, and feeling sad.

“I have never felt any happiness in the last 12 years I cannot even remember a day that I was happy It’s just sadness ”
[stroke survivor_9]

Stroke survivors reported that they suffer from the thought that the stroke is going to happen again at any moment now. A little bit of headache feels a lot after a stroke; they also reported there were times when they went to the emergency room thinking that it is happening again. Caregivers also reported that they would panic with the thought that their loved one is going to die anytime; especially when they passed even a minute from their medication time, they would feel distressed about it.

Trauma among stroke survivors’ children was another negative experience reported. Children face a huge amount of fear of losing their parents and get overwhelmed by the feeling. In some cases, this resulted in miss school and insisting to come to their check-up and physiotherapy sessions fearing that their parents might not come back home.

“My daughter wants to come to the hospital every time I come for a check-up or physiotherapy She is 9 years old, and she doesn’t trust when I come to the hospital because last time, she was very scared, so she will miss school and come with her mom”
[Stroke survivor 8]

Participants also reported changes in their emotions and emotional expressions after the stroke. They report being suddenly upset and tearful which on many occasions lead them to be frustrated when they face

different social situations because they feel embarrassed about their disability. Caregivers have also reported that they were less motivated to do what they used to, and they felt that their personality has changed a lot, reporting feelings of anger often for simple things and frequent mood changes.

“I fear to death that my children will also have stroke....it is a very scary thought...always in my head, I don’t want them to be like me...” [stroke survivor 12]

The emotional tolls and the trauma associated have led some to have suicidal ideation and attempts. They reported that they consider overdosing themselves or shooting themselves with a handgun or running into a moving bus to end their life. Sometimes emotional turmoil hits the participants and leads them to wish to end their life not to suffer any more.

“I thought about ending my life.... a lot it’s just I didn’t think I could I just did not want to live like this....it was all darkness.... very hard to explain... I thought of going to the streets and standing in front of a bus...”
[stroke survivor 9]

Elephant in the room

This theme describes the awkward and embarrassing moments survivors and caregivers face which resulted in affecting their social life. Survivors and caregivers face different aftermath of stroke which brings them emotional discomfort and presses them to intentionally ignore certain circumstances. They also reported feuds within the family, a mix of too much sympathy and too much criticism.

Survivors distance themselves from different social activities; caregivers reported that they did not have enough time to take part in one. They also reported the society as understanding the problem not expecting them to participate in different social events. Some survivors reported that they were reluctant to participate especially in happy events thinking that they would cloud others’ happiness with their inability to move around freely and they feel ashamed to take pictures.

“Sometimes I wanted to go to a friend’s or relatives’ weddings, but I do not want to ruin their memories, or pictures with my disability; I do not want to get in people’s ways. I just do not go; maybe if it is death I might just go like after the third day to pay my respect and condolences”
[stroke survivor_3]

Stroke survivors also reported that it is hard to continue the same relationship with friends they had before the stroke. It is hard for their friends to accept their changes after the stroke, and it is hard to talk

about it. They said they were also unable to do things they used to do together with their friends before the stroke mainly due to their disability; and because it brings sadness, they deliberately ignore their friends. They said talking to a new friend is easier because they do not know them before they had a stroke, so it was easier to accept them as they are now.

Some survivors reported that they have been exposed to too much emotional involvement like being overly protective or criticism about their conditions. Too much emotional involvement from extended families and friends makes them and caregivers uncomfortable which led them to not attend family events like birthday parties, weddings, and other social events. Survivors also reported that some family members think they were faking their condition for the sake of drawing attention which they say breaks their hearts.

"I cannot take their pity any more it is too much (kenfer meteta) All I want was to spend a nice time Just like old times.... But every conversation will be about my situation, and I hate that they pity me so much ... even if I told them to stop pitying me ...I still see it in their eyes; it would be nice if I could make new friends who did not know about the old meit might be easier for them to accept you like this...."
[stroke survivor_7]

Caregivers reported that people around them like to throw their personal beliefs about the stroke and how they should see what is happening in their life. They expressed that they have been told how they should be feeling or doing instead of asking them how they are feeling which has led them to restrict themselves from different social events. Even when people are not talking about it, though it is an obvious issue, it brings discomfort and awkwardness; they said it is like an 'elephant in the room'.

"Friends and family say it is for the best that this happens to our family, that God tests those he loves...and am angry with their opinion and comments because I am the one in it and I don't see any good in what is happening to mom"
[caregiver 11]

Some caregivers reported their relationship with their boy/girlfriends which they have been building before the stroke is suffering due to not giving enough attention and time to the relationship. Taking care of the survivor was also reported as time-consuming resulting in their personal life to pause.

"We were supposed to be married and start living together this year but my father ... it happened to us, this happen...so I have to give time for my family; we even broke up with my fiancé because she could not understand what I am dealing with; I

could not have a wedding while my father is like this"

[caregiver 3]

A caregiver reported a long bitter quarrel within the family about different types of treatment options, physiotherapy sessions and caregiving schedules for the stroke survivor. They reported that they put off these discussions because it would generate arguments within the family. This family feud resulted in never speaking to each other again in some members.

"I argue with my brother a lot about the medication our father is taking He only wants to take him to the holy water ...while I insist that he should also take his medication with it"

[caregiver_3]

Finding the Silver Lining

Participants reported the common coping mechanisms they have employed. Stroke survivors reported surviving the stroke as a blessing. They considered the time given to them to do things right and to count their blessings. They reported that the situation after the stroke has been taken as a reminder to count their blessings, to tell their loved ones how much they meant to them, to thank God and to take time for themselves. Caregivers also have set their minds to be thankful to God that they have their loved ones around despite all the limitations.

"I used to be a soldier ... I am the man of the house, I wanted everything to be done my way, only my way ... I have never listened to my wife nor the children ...but after the stroke, it gave me time to be calm, I do not shout like I used to ... I realize I was the one disturbing my family ...now I listen to them, pray to God, have time for myself... I have never felt calmer ...it's just sad it took a stroke to realize this "

[stroke survivor_10]

A participant also reported that stroke made the family gather around, rely on each other, and felt happy that they can rely on each other during such a tough time as this.

"We used to live very separate life with my siblings, due to many reasons work, marriage, ... after our father became like this the house gets full again, they all visit frequently and spent a lot of time, our mother is very happy; they also cover for me when I need to go out or stay out late"

[caregiver_3]

Though some participants reported seeing the light at the end of the tunnel and can enjoy the opportunity and the second chance after the stroke; some reported

the experience after stroke as a situation where they cannot think of getting out of it. They reported that trying to find something good out of this was impossible.

“All I see is a mess; I do not know how we are going to come back from this...as I told you my sister’s marriage is destroyed because her husband cannot tolerate the time she spends taking care of our mom; as well as my life and marriage ... it’s like I have to be in two places at onceeverything is a mess...cannot see a better future because things are getting worse by the day...”
[caregiver_11]

It has been reported that celebrating little milestones that the survivor achieves has been helping families and extended relatives to bond over it and help them get closer. Reading books, praying, taking a long walk, spending time with family and sleeping to avoid certain situations were the reported ways of dealing with different emotions and situations.

Feedback

At the end of the interview, we asked the participants how they felt about talking or taking part in this interview; most of the participants took their time to answer the questions and were open about their experiences.

Participants reported that they were nervous in the beginning, but they were glad they were asked and talked about the issues out loud because mostly they would just say *“I am fine”* and move along. But they reported that they were glad they were able to speak and felt heard.

Participants also reported being anxious while talking about their experiences. It made them face different feelings they were putting aside even though they felt good at the end, and it was emotional to think about the emotions they are going through.

“I am sorry about earlier It is just hard to talk about things nowadays because ... it gets hard with time to talk about it when no one is there to talk to you about it” “
[stroke survivor_9]

“Thank God someone is considering what I am going through and interested in what I am feeling ...you know after her stroke, and she became like this no one wants to know how I am feeling or what I am going through They might say thank God your mother has you by her side, but they do not consider or ask who is by your side ...”
[caregiver_11]

“As a man, it’s hard to see your father like this but it’s even harder to put your feelings out there and let the rest of the family know that you are tough, or I do not cry because I am a man.... but feelings pile up that might be the reason that I cried I do not understand you telling me that crying is a good thing But I feel good now It made me think about my brothers that they may want to talk ... not just about medical bills, medication time or physiotherapy time.... but I will ask them to talk.... we created this front to be strong, especially for our mother and try not to feel ... now am thinking about what our little brother must be going through”
[caregiver_7]

Discussion

In this qualitative study, we interviewed a good number of stroke survivors and caregivers to explore the social and psychological experiences of stroke survivors and caregivers and their coping mechanisms. Our study is unique in many ways. First, it was conducted in a resource-limited setting where social services are entirely left to families and where there is limited access to rehabilitation care for stroke survivors. The limited available service is also limited to physical rehabilitation where the needs of the survivors are multifaceted, including psychological services. Second, we have included the overlooked patients’ caregivers while their role and burden are very high in such settings. Third, we have included the perspectives of recent and chronic survivors and their caregivers which can be essential for interventions targeting stroke survivors and the informal caregivers.

We identified six themes in this study: explanatory model, new body, living on the breadline, psychological toll, elephant in the room and finding the silver lining. The explanatory model describes participants’ understanding of and causes of stroke. This theme narrates the survivor’s and caregivers’ expression of the journey after a stroke. The second theme new body explained survivors’ experience with their bodies being uncomfortable after a stroke. It elaborates on how they feel like they have no control over their body mainly because of the disability that came after the stroke.

The third theme, living on the breadline emphasizes the financial struggles of survivors and caregivers; and hand to mouth existence they face after stroke. In this theme transportation and medication cost contribute to the struggle they deal to make ends meet. The fourth theme, psychological toll describes different psychological problems like anxiety, sleep problems, stress, sadness, and trauma they experience after the stroke. Suicidal ideation was also another psychological problem that was raised in this theme.

Table 2: Summary of theme with their description

Theme 1	Theme 2	Theme 3	Theme 4	Theme 5	Theme 6
Exploratory model	New body	Living on a breadline	Psychological toll	Elephant in the room	Finding a Silver lining
Insight about stroke Cause Early days Physiotherapy journeys Treatment options	Disability Not feeling like themselves no control over their body Unable to take care of a newborn	Financial crises Forced Retirement Unable to go back to work Children missing school	Fear Panic Anxiety Sleep problems Trauma Loss of interest Suicidal ideation	Social isolation Family feud Too much sympathy Too much criticism	Taking it as a second chance in life Time to count their blessings Time to serve their loved ones Family sticking together Adjusting to a new lifestyle Adjusting to medication Adjusting to the role shift Coping through praying Talking with friends, reading and Taking a walk

The fifth theme elephant in the room refers to different situations and controversial issues like disability, the changes within their family, and social situations which brings them sadness or arguments. It explains how participants tend to deliberately avoid discussions and hold themselves from participating in social events and ignore family arguments.

The final theme finding a silver lining, how the participants were able to see the light at the end of the tunnel and gained hope. This theme describes the positive things like caregivers getting a chance to serve their families, taking it as a second chance and taking time to count their blessings through this chaotic event. In this theme, participants describe how they try to adjust to the new normal and how they have been using prayers and talking to friends as a way of coping.

Post-stroke recovery usually involves a continuum of care (15, 16). In this continuum, communication about the recovery process among physicians, survivors, and families plays a significant role in improving outcomes (17). The survivors and their family members may not fully understand this process as was seen in our study. Service providers need to work in collaboration with the survivors and caregivers to prepare them regarding what to expect, the estimated duration of possible changes, and the resources required.

The financial crisis was one of the most frequently raised consequences of stroke in this study. This is an

understandable outcome of the problem in a country where there is no social security and where needs are expected to be met by the family who even under normal circumstances could have been struggling for survival. In some cases, victims of stroke were the breadwinners of their families. Caregivers who also used to contribute to the family economy would be forced to work shorter hours or stop working because of the time-demanding nature of caregiving to stroke survivors. The cost of medical care, rehabilitation and transport also increases the financial burden on the family in addition to the cost of living. As was suggested in previous studies, this might call for compensating strategies for informal caregivers to alleviate their financial challenges (18).

The emotional roller coasters were reported by both the survivors and their caregivers. The emotional problems may be serious enough to end their life. The psychological consequence may be more pronounced in low-income settings where the treatment gap for both physical and psychosocial care is high (7, 19). This warrants the need for psychological support for both the survivors and their caregivers. The psychological support may also have a positive contribution to their physical rehabilitation (20) and better quality of life (21)

Stigma related to stroke was reported to lead to depression and lower quality of life among stroke survivors in previous studies (22, 23, 24). In our study participants described how they distance themselves

from different social gatherings due to low self-perception, altered self-image, and negative self-talk; which needs a comprehensive intervention focusing on self-perception and self-image (25).

Though it is not commonly reported in stroke studies, stroke survivors in our study reported the negative consequences of expressed emotion towards them. Some reported overprotection while others reported over criticism. Since the concept of expressed emotion is usually reported in mental health conditions such as schizophrenia (26), it is important to assess the role of expressed emotion in the stroke care journey in the future studies.

It was evident in our study that caregivers play an important role in poststroke care. However, it was seen that they suffer from lack of information, loss of job, economic constraint, and psychological problems as also seen in other different studies (27, 28). Their needs can be addressed through the Timing it Right framework. This framework describes the changing needs of caregivers in the recovery trajectory. It has been shown that caregivers also benefit from receiving support from healthcare professionals (29), family, friends, and caregiving peers (30).

The coping mechanisms applied by the survivors and the caregivers are important aspects of the care process (31). In the current study, participants used different adaptive coping mechanisms such as considering their survival as a second chance in life. Some caregivers also took it as an opportunity to serve their loved ones. The other coping mechanisms including praying, being grateful, and talking and spending time with family and friends can be communicated as effective health promotion strategies (32, 33, 34, 35).

Though this study can be considered the most comprehensive report in such a setting, it is not free from limitations. First, though understanding stroke survivors with communication difficulties to ensure long-term care is very important (36); the findings in this study may not reflect the experience of stroke survivors with communication difficulties. Second, since we only recruited participants who came to the rehabilitation clinic and possibly had better social support and economic status, we may have missed some worse experiences and consequences of the illness.

In conclusion, we explored the consequences of stroke among stroke survivors and their caregivers and found that survivors face an inability to return to work because of disability. Financial strain, and different emotional ups and downs including sadness, hopelessness, trauma, and suicidal thoughts are also important findings of this study. Caregivers are found to be hidden patients with experiences of their own physical health, sleep problems, financial stress, and emotional burden. These all show the need for urgent

and compressive interventions. Taking a walk, praying, sleeping, and reading books have been reported as useful coping mechanisms.

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Availability of data and materials

The datasets generated and analysed during the current study are not publicly available to protect participants' privacy but are available from the corresponding author upon rational request.

Competing interests

The authors declare there is no conflict of interest.

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Authors' contributions

SS and AA conceived the study, and they were part of the whole process of the study. CS participated in the design of the study, reviewed all versions, and made corrections. WF participated in the design of the study and analysis of the data, reviewed all versions, and made corrections. All the authors read and approved the last version.

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Original Article

Lens-induced glaucoma - In a Tertiary Eye Care Center, Ethiopia

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Abstract

Background: Lens-induced glaucoma after untreated mature cataract is the commonest cause of secondary glaucoma in the developing world. The purpose of this study was to determine the common clinical features of lens-induced glaucoma, its management, and its outcome at Menelik II tertiary hospital, in Ethiopia.

Methods and Materials: This was a retrospective study of cases that were seen at the hospital from January to December 2020. Lens-induced glaucoma patients who undergo cataract extraction were included in the study. Medical charts review was performed, and analysis was done using SPSS version 24.0 Software.

Results: Forty-four lens-induced glaucoma patients were included in this study. Female participants were 65.9%. The mean age was 63.3(±Standard deviation (SD) 8.7) years. Phacomorphic glaucoma 88.6% was the leading cause. The common clinical symptoms identified were eye pain (100%), visual reduction (97.7%), and redness (38.8%). Visual acuity (3/60) or worse was reported in all patients with mean intraocular pressure of 37.3mmHg. After cataract surgery, the mean intraocular pressure reduced to 14.5± 6.55 mmHg while vision improved to better than 6/60 in 28 (63.6%) of patients. Of these, 21 (75%) patients seek medical treatment in the first two weeks of initial symptom.

Conclusion: This study has identified the main cause of LIG was phacomorphic with the common clinical findings of pain, redness, and visual reduction. Early cataract extraction was associated with better final visual recovery and intraocular pressure control. An intraoperative complication was often observed in those with delayed presentation. Therefore, creating awareness among the general population and healthcare givers is key to the timely management of lens-induced glaucoma.

Keywords: Glaucoma, Cataract, Phacomorphic, Intraocular pressure, Visual acuity

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Introduction

In Ethiopia blindness and low vision are major public health problems. A large proportion of low vision (91.2%) and blindness (87.4%) are due to avoidable (either preventable or treatable) causes. According to a 2006 national Ethiopian survey report, the prevalence of low vision was 3.7% and blindness was 1.6%. Cataract was the leading cause of both blindness (50%) and low vision (42%).^(1, 2)

Ethiopia burdens a larger number of cataract blindness, with an estimated backlog of 800,000 people. Only 70,000 Ethiopians receive cataract surgery each year, leaving hundreds of thousands waiting for surgery.⁽³⁾

Lens-induced glaucoma (LIG), also called lens-related glaucoma is one of the common causes of

secondary glaucoma in developing countries. It results from delayed cataract surgery which compromises the function of the optic nerve due to a rise in intraocular pressure. Elevated intraocular pressure (IOP) in lens-induced glaucoma has different mechanisms which include mechanical blockage of trabecular meshwork by lens particles or inflammatory cells, lens swelling/malposition from zonular weakness resulting in forward movement of iris lens diaphragm then secondary angle closure glaucoma finally resulting in permanent optic nerve damage and irreversible blindness.^(4, 5, 6) Even though timely cataract surgery is the absolute management to prevent LIG, there are multiple factors identified for delayed treatment which include low socio-economic status, distance from the service, relatively better vision in the other eye, and poor awareness. On the other hand, uneven

distribution of infrastructures, and personnel, insufficient attention, and provision from the government contribute to a lower cataract surgical rate in Ethiopia.⁽⁷⁻¹⁰⁾

Understanding the clinical presentation, the cause and the management outcome of LIG is important input in blindness prevention strategies.

Therefore, this study was done with the main aim of assessing the demographics, clinical features, and surgical outcomes of LIG patients at a tertiary referral hospital.

Materials and Methods

Study Design and Setting

A retrospective chart review of records of LIG patients was completed for those who underwent cataract surgery between January to December 2020, at Menelik II Hospital: a tertiary training eye care center in Addis Ababa, Ethiopia.

Sampling: Size Determination and Technique

Lens-induced glaucoma patients who visited the hospital from January 2020 to December 2020 were the study targets. All consecutive lens induced glaucoma patients during the study period, who fulfilled the inclusion criteria were enrolled in the study. Therefore, the study included 44 eyes of 44 patients.

Data Collection Instrument

Ophthalmic surgical registration logbooks were used to identify chart numbers of LIG patients during the study period and charts were collected from the hospital chart room by the responsible person. Eligible participants were screened after a detailed medical chart review.

Inclusion and Exclusion Criteria

Those who fulfilled all the inclusion criteria were involved in the study. The criteria include: 1) Age above 40, 2) Cataract with a rise in IOP causing symptoms like the acute onset of pain, redness, tearing, and progressive visual loss, 3) Slit lamp finding of intumescent, mature cataract, lens particles or lens displacement with raise IOP. 4) Who has undergone cataract extraction and had follow-up for at least 3 months. Exclusion criteria were: 1) known history of glaucoma diagnosis, 2) other secondary causes for glaucoma, and 3) Unclear diagnosis or incomplete data.

Data Collection Procedure

A data collection format was prepared and filled by the primary investigator for 1) Socio-demographic information 2) Clinical characters including presenting symptoms and duration at an initial hospital visit, distance visual acuity, IOP, and recorded findings from slit lamp bio-microscopy 3) Preoperative investigations like ocular biometry for axial lengths and preoperative medications, 4) Intraoperative findings and the type of surgical procedures 5) Postoperative

findings and managements at 1st postoperative day, 1st week, and 3rd month (at discharge).

Operational Definitions: LIG was defined as the presence of elevated IOP in a setting of lens-related problems. Based on the condition of the cataractous lens LIG is further classified as phacomorphic glaucoma, phacolytic glaucoma, Phacoanaphylactic, and LIG due to lens malposition. Cases were diagnosed as phacomorphic glaucoma in the presence of pain, redness, and signs of corneal edema, shallow anterior chamber, intumescent lens, and elevated IOP > 21mmHg. Phacolytic glaucoma was defined by hypermature cataracts with an undisrupted anterior lens capsule with lens protein and flare in the anterior chamber. The diagnosis of a subluxated/dislocated lens was made after examining the position of the lens with a slit lamp. The delayed presentation was defined as seeking health care service after two weeks of the onset of symptoms.^(18, 20, 22)

Data quality control and analysis

The principal investigator revised each data for completeness and entered it into SPSS version 24 software to compute descriptive statistics like frequencies, percentages, mean and standard deviations. P-values less than 0.05 were considered statistically significant.

Result

Forty-four patients with lens-induced glaucoma who had undergone cataract surgeries were included in the study. Fifteen (34.1%) were male and 29(65.9%) were female. The mean \pm SD age was 63.3 ± 8.7 years (range, 45-80) and the majority were (45.5%) between 61-70 years. Most of the patients 37(84.1%) were residents of Addis Ababa, a capital city.

Phacomorphic glaucoma was the major type of LIG (39, 88.6%), followed by subluxated/dislocated lens (4, 9.1%) and phacolytic glaucoma (1, 2.3%).

The main clinical symptoms were eye pain (100%), reduced vision (97.7%), redness (38.8%), headache (22.7%), and nausea (2.3%). The time gap between initial symptoms to seeking medical help was recorded in weeks. Fifteen (34.1 %) patients looked for treatment in less than one week, 17(38.6%) came within 1-2weeks, 7(15.9%) were presented within 2-4 weeks while 5(11.4%) had symptoms for more than one month before the hospital visit.

Snellen's visual acuity records of all patients were less than 3/60 at the initial presentation. Of them, 91% had visual acuity of hand motion or light perception.

The intraocular pressure range at the initial hospital visit was from 23 to 66 mm Hg with a mean IOP of 37.3 ± 10.29 mmHg. A large number of patients (75 %) recorded an IOP greater than 31 mm Hg at their first visit. Reduction of IOP less than 20 mm Hg was attained in 31 (70.5%) eyes after the first week of cata-

tract surgery. On the last follow-up visit (3 months from cataract surgery), 39(88.6%) eyes were free of medication with IOP below 20 mm Hg and one patient had to use a single topical hypotensive drug. Four eyes remained with uncontrolled high IOP despite the use of two or more topical anti-glaucoma medications. The mean postoperative IOP at discharge was 14.5 ± 6.55 mmHg. (**Table 1**)

Table 1 Intraocular Pressure Before and After Cataract Extraction of LIG Adults Who Received Cataract Surgery at Menelik II Hospital, 2020 (n=44)

IOP interval in mmHg	Preoperative at the initial visit		Post-operative at discharge	
	Patient No.	Percent	Patient No.	Percent
0-20	0	0	39	88.6
21-30	11	25	3	6.8
31-40	18	40.9	1	2.3
41-50	11	25	1	2.3
51-60	1	2.3	0	0
>60	3	6.8	0	0
Total	44	100	44	100
Range	23-66mmHg		6-41mmHg	
Mean	37.3 mmHg		14.55mmHg	

LIG, Lens-Induced Glaucoma; IOP, Intraocular Pressure.

As part of preoperative evaluation and preparation, the value of axial length measurement was possible to obtain for 40 patients with a mean value of 22.9 ± 1.13 mm (Range, 20.65mm to 25.00mm). Even though 9 eyes had axial lengths below 22.00mm, this was not statistically significant when seen with the type of LIG. ($p=0.1$)

At the initial visit, all patients were given preoperative topical steroids to control inflammation. The majority of them, 42(95.5%) also received topical hypotensive drops preoperatively and 31 (70.5%) needed additional systemic hypotensive medication (acetazolamide tablets) to lower their eye pressure before surgery.

Cataract extraction surgery was done for all patients with or without intraocular lens implantation. Manual small incision cataract extraction procedure was the choice for 38(86.4%) eyes while extracapsular cataract extraction was done for 6 eyes (13.6%). Thirty-

six (82%) patients had IOL implantation at the posterior chamber while 8(18%) eyes remained aphakic because of poor posterior capsular support and vitreous loss.

Data on the status of the fellow eye was also obtained from the record. Nine eyes (20.5%) were pseudo-phakic with visual acuity from 6/60 to 6/9 and 8 (18.1%) eyes had NLP due to trauma, complicated previous cataract surgeries, and non-operated complicated cataract in 2, 2, and 4 eyes respectively. Immature and mature cataract was documented in 25 and 2 eyes respectively. Those who were bilaterally blind due to either absolute blindness (NLP) or mature cataract in the fellow eye gained postoperative vision better than 6/60 in the affected LIG eye.

In this study, unaided visual acuity at 3 months postoperative follow-up was better than 6/18 in 6(13.6%) of patients. Half (50%) of patients had Snellen's distance visual acuity between 6/18-6/60 at the end of their follow-up. Visual acuity of below 3/60 was recorded in 15 patients (34.1%) due to aphakia with persistent corneal edema in 6 patients and glaucomatous optic nerve damage in 7 patients. The cause of low vision was unrecorded in two patients. (**Table 2**)

Table 2 Preoperative and Postoperative Visual Acuity of Eyes with Lens-Induced Glaucoma of Adults Who Underwent Cataract Extraction, 2020 (n=44)

Snellen's Visual Acuity	Preoperative (Initial visit)	Post-operative at discharge (3 months/ last follow-up)
NLP	0 (0%)	0 (0%)
LP	32 (72.7%)	3 (6.8%)
<3/60-HM	12 (27.3%)	12 (27.3%)
3/60-<6/60	0 (0%)	1 (2.3%)
6/60-<6/18	0 (0%)	22 (50%)
6/18-6/6	0 (0%)	6 (13.6%)
Total	44 (100%)	44 (100%)

LIG, Lens Induced Glaucoma; NLP, No Light Perception; LP, Light Perception; HM, Hand Motion

Out of 28 cases who regained distance visual acuity of 6/60 or better at the end of their follow-up, 21 (75%) were presented within 2 weeks of the onset of symptoms. An early hospital visit and relatively lower initial IOP was seen in eyes with better visual acuity at the end of their follow-up. (**Table 3, 4**)

Table 3 Snellen's Visual Acuity at last follow up in Relation to The Duration of Symptom at Presentation of LIG Adults Who Received Cataract Surgery at Menelik II Hospital, 2020 (n=44)
LIG, Lens-induced glaucoma.

Duration of symptoms at the initial visit	Visual acuity at discharge/ last visit and number of eyes			
	6/6-6/18	<6/18-6/60	<6/60-3/60	<3/60
< 1 week	4	7	0	4
1-2 weeks	2	8	0	7
>2-4weeks	0	5	0	2
>1 month	0	2	1	2
Total	6	22	1	15

Table 4 The Relationship Between Preoperative IOP at Presentation and Final Visual Acuity at Three Months of Lens-Induced Glaucoma Adults Who Received Cataract Surgery at Menelik II Hospital, 2020 (n=44)

Preoperative IOP at presentation (mmHg)	Visual acuity at discharge (3 months) and number of eyes			
	6/6-6/18	<6/18-6/60	<6/60-3/60	<3/60
21-30	4	3	1	3
31-40	2	8	0	8
41-50	0	7	0	4
51-60	0	1	0	0
>60	0	3	0	0
Total	6	22	1	15

LIG, Lens induced glaucoma; IOP, Intraocular pressure.

Cataract extraction was uneventful in 29(65.9%) of patients. The major intraoperative complications observed were zonular dialysis in 8 (18.2%), posterior capsular rent with/without loss of vitreous in 4(9.1%), and poor pupillary dilation in 3(6.8%). Delayed presentation greater than 2 weeks was observed in 42% of cases with intraoperative complications. Ten (66.7%) of cases with these intraoperative complications had final visual acuity below 3/60. (p=0.00)

The most common early postoperative complication was striate keratopathy which was documented in 35 (79.5%), anterior segment inflammation in 6(13.7%), and cortical remnant in 3 (6.8%). Some of the late complications include persistent edematous cornea in 4 eyes besides uncontrolled high intraocular pressure in four eyes.

Discussion

This study assessed the overall clinical presentation of patients with LIG including, level of distance vision and IOP change before and after cataract extraction along with intraoperative and postoperative complications.

From the study result females' predominance was observed over males 29 (65.9%), which is parallel to studies by Shrestha et al (57%), I.S.V.S et al (58%), and Rajkumar P. (62.3%). This might be explained by the poor medical-seeking behavior of older women, and social, cultural, and economic constraints. Another reason for female predominance could be the anatomic predisposition of females with shallow anterior chambers for the development of LIG. (5, 6, 11)

LIG is a disease of elderly people related to the formation of cataracts and its complications. This fact was also seen in this study occurring at the mean age of 63.3 years. Studies by Shrestha, Jarwal PN, and Sharanabasamma have also reported the mean age of affected people as 61.1-year, 61.6-years and 60.8 years respectively. (5, 12, 13)

Phacomorphic glaucoma was the most common cause in (88.6%) of our study in agreement with other studies from southern India (78. %), Rijal et al (65%), and Pradhan et al (72%). (14-16)

Subluxed /dislocated lens was higher in this study (9.1%) than with I.S.V.S et al (2%) and Rajkumar et al (2.7%) since our study included trauma-related lens displacement, unlike the other reports. (6, 11)

The mean IOP at the initial visit was 37.27mmHg which correlates with studies by R. Ramakrishnan et al (mean 38.4mmhg) and Shrestha R et al (mean 42.74 mmHg). Many patients (88.6%) had post-operative IOP below 20mmHg with no medication. This explained the cause of high IOP was lens related and its removal will result in IOP control. Similar results were obtained from studies led by Yaakub et al and Sharanabasamma with mean IOP 15.2mmHg and 15.6mmHg respectively. (5, 13, 17, 18)

In our study, all patients had initial Snellen's visual acuity in the category of blindness. The light perception was seen in 72.7% and visual acuity was worse than 3/60 in 27.3%. Similar findings were reported by Raghunandan K. and Mohindar S that reported LP in 78.0% and 90% respectively. The low visual acuity at presentation was attributed to corneal edema and cataractous lens. (19-21)

The Snellen's visual acuity (uncorrected) after three months of cataract surgery has been reported 6/18 or superior only in 13.6% of eyes, 6/60-<6/18 in 22 (50%) cases, and below 3/60 in 15(34.1%). The reason for lower visual acuity was surgical aphakia, per-

sistent edematous cornea, and glaucomatous optic neuropathy. Additionally, this lower vision could be explained by the fact that the final visual acuity taken was uncorrected.

In this study, the common postoperative complications were striate keratopathy in 79.5%, inflammation in 13.7%, posterior capsular rent with loss of vitreous in 9.1%, and cortical fragments in 6.8%. Similar findings were reported by Raghunandan K. and Venkataratnam with posterior capsular tear at 10% in both studies, cortical remnants at 6.0% and 12%, and inflammation at 33.3% in both studies. A higher percentage of striate keratopathy was reported in our study than in these studies which reported 24.6% and 26% respectively. This higher level of striate keratopathy in our study was associated with initial corneal edema and shallow anterior chamber at the initial hospital visit which was observed in 68% and 95.5% of cases respectively.^(14, 17, 20)

Glaucomatous disc damage (VCDR > 0.7) was observed in 29.5% of eyes which correlates with 34.0% of D Pradhan et al study. Higher IOP >31mmHg at presentation contributed to 69% of optic atrophy in our study with $p=0.64$.⁽¹⁶⁾

Despite the painful nature of the disease, delayed presentation was seen in 12 patients. This could be due to the acceptance of poor vision as aging which is seen in 25% of bilaterally blind patients. The presence of better vision in the fellow eye also contributes to delayed presentation in 18% of pseudophakic fellow eyes. Other factors include poor health education, fear of operation, lesser expectations, socio-economic constraints, waiting for the cataract to get matured, misdiagnosis, and a delayed referral system.

Conclusion

This study has identified the main cause of LIG was phacomorphic with the common clinical findings of pain, redness, and visual reduction. Early cataract extraction was associated with better final visual recovery and intraocular pressure control. Intraoperative complications were often observed in those with delayed presentation. Therefore, creating awareness

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among the general population and healthcare givers is key to the timely management of lens-induced glaucoma.

Limitation of the Study

As this study was a retrospective study it was a challenge to get complete data on the clinical profile of patients which leads to a higher rate of exclusion of samples. The sample size was small to generalize, and it was also difficult to identify the factors associated with the delayed presentation of patients.

Abbreviations

HM, Hand Motion; IOP, Intraocular Pressure; LIG, Lens Induced Glaucoma; LP, Light perception, NLP, No Light Perception; PMG, Phacomorphic glaucoma.

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Ethical Consideration

The study proposal was presented and submitted to the Research and Publication Ethics Committee of Addis Ababa University and approval was obtained. The study was done in agreement with the declaration of Helsinki. All patient data were kept confidential.

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Original Article

Clinical observation of patients with fractures of the proximal humerus bone in Kazakhstan

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Abstract

Background: Treatment of patients with fractures of the proximal humerus remains an urgent problem of modern traumatology and orthopedics. The aim of this work was to study the results of surgical treatment of patients with proximal humerus fractures in which plates with angular stability of screws were used for osteosynthesis.

Materials and methods: Thirty six patients aged 18 to 75 years with fractures of the proximal humerus, were observed after treated in the polytrauma department of the City Clinical Hospital No. 4 in Almaty, Kazakhstan during the period from August 2019 to December 2021. There were 12 men (33.4%) and 24 women (66.6%). According to the C.S., Neer patients were distributed as follows: two-part patients - 17 (47.2%), three-part patients - 11 (30.6%), four-part patients - 5 (13.9%), fracture-dislocations of the humerus head - 3 (8.3%). Most of the patients applied before 3 days after injury (53.0%).

Results: Positive treatment results were achieved in most cases with two and three fragmentary fractures and in those operated early (from 3 to 7 days) after injury. Plates with angular stability of the screws provided excellent and good treatment results in 69.5%, and a satisfactory result in 16.7%. The unsatisfactory results of treatment were 13.8%, and the incidence of postoperative complications was 19.4%.

Conclusions: Performing stable osteosynthesis in three- to four-fragment fractures and fracture-dislocations of the humerus head is technically a difficult operation. A study of our material and literature has shown that the incidence of complications after extra-cortical osteosynthesis of the humerus is associated not only with the surgical technique of implant placement, but also with the nature of the damage, including osteoporosis, osteonecrosis, and pathology of bone tissue regeneration.

Keywords: fractures of the humerus, proximal humerus, internal osteosynthesis, lockable plates.

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Introduction

Treatment of patients with fractures of the proximal humerus remains an urgent problem of modern traumatology and orthopedics [1,2]. According to the literature, such fractures account for 4-6% of the structure of all skeletal bone fractures [3,4,1], and according to some data, up to 12% [5,6], and among humerus fractures, 45 to 80% of cases [7,8].

The method of choice in the treatment of displaced fractures is repositioning and osteosynthesis [9,10]. Many constructions are used for fixation of such fractures: T- or L-shaped plates, plates with angular screw

stability, interlocking intramedullary nails, external fixation devices, Kirschner spokes, titanium nickel-ise fixators with memory, suture materials, bone grafts and endoprostheses of shoulder joint [11,12,13,14,15,16,17].

Currently, LSP and LPHP - angularly stable screw plates [18,19,20].

G.J. Haidukewych (2004) [18] believes, that when screws are blocked in the plate, the angle between the screw and the plate will be rigidly fixed. Thus, plates with angular stability of screws have a mechanical advantage in the case of fractures with a

comminuted metaphysis, especially in cases where there is insufficient contact between the fractures [19,20].

Despite the aforementioned advantages of the plate with the angular stability of the screws, the percentage of postoperative complications doesn't decrease. According to different authors, the complication rate after shoulder osteosynthesis with an angular screw stability plate ranges from 3.7 to 33.5% [21,22,23,24]. Thus, during the treatment of fractures, impingement syndrome, aseptic necrosis of the humeral head, adhesive capsulitis, metal structure migration, vascular and nerve damage, infection, non-union of the fracture and pseudarthrosis may develop, which may subsequently require repeated operations [25,26,27,12,15,19].

According to researchers, the development of such complications can be not only the result of a violation of surgical technique of implant placement, and selection of metal structures, but also the nature of the damage, including osteonecrosis, osteoporosis, pathology of bone tissue regeneration [27,25,12]. To reduce complications, a number of researchers used bone cement in patients with severe osteoporosis [28,29,30,31].

Some authors, when fixing a fracture with a plate, simultaneously used a fibular graft (6-8 cm long), which was placed intramedullary and proximal to the neck of the shoulder, thereby providing support along the inner surface of the humerus, taking into account the weakness of the bone plate on the medial side [32,33].

Thus, the improvement of both the means of osteosynthesis and the methods of restorative treatment for near- and intra-articular fractures of the humerus is an urgent problem of modern traumatology, and therefore often attracts the attention of researchers. The purpose of this work was to study the results of surgical treatment of patients with proximal humerus fractures in which plates with angular stability of screws were used for osteosynthesis.

Materials and methods

We observed 36 patients aged from 18 to 75 years with fractures of the proximal humerus who were treated at the polytrauma department of State Clinical Hospital No. 4 in Almaty, Kazakhstan during the pandemic "Covid - 19" period from August 2019 to December 2021.

There were 12 (33.4%) male patients and 24 (66.6%) female patients. The ratio of women to men was 1:1.7. This trend is explained by hormonal changes in the female body, beginning in the post-menopausal period. Among the victims under the age of 44, males predominated (27.9%) due to the number of injuries

sustained as a result of road accidents, and men are known to be more susceptible to this type of injury.

The study included patients aged 18 to 75 years with closed fractures of the proximal humerus, which required surgical treatment, and the minimum follow-up period was 1 year.

The study did not include patients under the age of 18 and over 75 years, patients who received conservative treatment, endoprosthetics, as well as patients with pathological shoulder fractures and without displacement of bone fragments.

All patients underwent osteosynthesis of the humerus using a plate with angular stability of screws and standard anterior deltoid-thoracic (pectoral) access was used.

Surgical technique

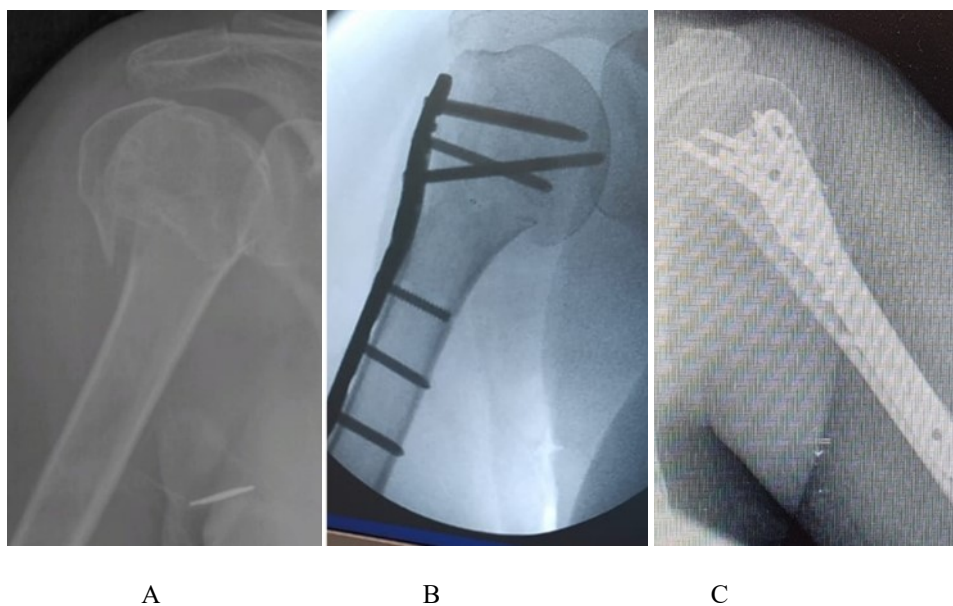
The patient was lying on his back or with the head end raised by 30°. Standard deltoid-thoracic access was performed. The deltoid muscle was diverted laterally, the pectoralis major muscle — medially.

The tendon of the long head of the biceps muscle of the shoulder is identified. It is located in the inter-tubercular furrow. The fracture was repositioned and temporarily fixed with spokes, the reposition was controlled by an electron-optical converter (EOC). The plate was located approximately 8 mm distal from the tip of the large tubercle.

The more proximally the plate is located, the higher the risk of developing subacromial impingement syndrome. In order to block the screws in the plate, the direction of insertion of the screws must exactly correspond to the direction of the thread in the hole.

For stable fixation, the proximal part of the plate must be fixed with at least 4-6 lockable screws, especially with poor bone quality; at least 3 bicortical lockable or 4 bicortical standard screws must be inserted into the distal fragment.

Clinical case



Picture 1. a – X-ray picture of the patient on admission; b – direct X-ray picture of the shoulder after osteosynthesis with a locking plate; c – axial X-ray picture after osteosynthesis.

X-ray picture of patient K., 37 years old with a diagnosis of "Close oblique fracture of the surgical neck of the right humerus with displacement (fracture B3.1 according to the AO/ASIF classification, two-fragment fractures according to Nir)"

In the postoperative period, immobilization was 2-3 weeks. After the immobilization was removed, the patients were prescribed physiotherapy procedures, physical therapy, and massage of the shoulder girdle

muscles.

Complications were observed in 7 (19.4%) patients during treatment. The frequency of patients with fractures of the proximal humerus, who had complications during treatment is shown in Table 2. It should be noted that out of 7 (19.4%) patients, 2 (5.5%) had a satisfactory result, 5 (13.9%) had an unsatisfactory result.

Table 1 - Frequency of patients with fractures of the proximal humerus, who had complications during treatment.

Types of complications	Number of patients	
	Absolutenumber	%
Impingement syndrome with shoulder joint contracture	3	8,4
Varus deformity of the humerus with Contracture of the shoulder joint	2	5,5
Avascular necrosis with shoulder joint contracture and migration of screws into the joint	2	5,5
Total	7	19,4

According to Table 1, impingement syndrome was observed in 3 (8.4%) patients with type B3, C2 fractures (three- and four-fragment fractures), and the complication was combined with varus collapse of the head and persistent contracture of the shoulder joint in all cases.

In 2 (5.5%) patients with a type C2 fracture (four-fragment fracture and fracture dislocation) on the background of an improperly fused fracture due to varus deformation, a contracture of the shoulder joint of the 2nd degree was formed.

Avascular necrosis of the head of the humerus developed in 2 (5.5%) patients (four-fragment fractures and fracture-dislocation), caused by a malpositioned fracture with varus deformation of the shoulder head and with adductor contracture of the shoulder joint. The analysis of complications developed during treatment is presented in Table 2. Out of 7 (19.4%) patients, only 12 (33.3%) complications were observed.

Table 2 – Types of complications in patients, taking in to account the type of fracture.

Typesofcomplications	Numberofcases	
	absolute number	%
Impingement syndrome with shoulder joint contracture	3	8,4
Varus deformity of the humerus with contracture of the shoulder joint	6	16,7
Avascular necrosis with shoulder joint contracture and migration of screws into the joint	2	5,5
Migration of screws to the joint	1	2,7
Total	12	33,3

The average age of the operated patients was 48.0 ± 2.4 years. Fractures of the right humerus were registered in 21 (58.3%), and 15 (41.7%) of the left humerus.

Among the patients, pensioners prevailed - 26.0%, workers – 23.0% in second place, and temporarily unemployed - 22.6% in third place. The cause of fractures was a domestic injury (37.5%) and road accidents (27.9%). The vast majority of pensioners was injured at home and rarely - as a result of road accidents and does not get injured at all at work.

According to C.S. Neer's classification, the patients were distributed as follows: two-fragmentary - 17 (47.2%), three-fragmentary - 11 (30.6%), four-fragmentary – 5 (13.9%), fractures-dislocations of the humerus head – 3 (8.3%). Most patients applied up to 3 days after the injury (53.0%).

According to the Swiss AO/ASIF classification [34], type A fractures were the most common, which occurred in 20 (55.5%) patients, including A 3 types. The second place was occupied by fractures of type B in 11 cases (30.5%), including fractures of type B1 and B2 were observed with the same frequency. Type C fractures were observed only in 5 (14.0%) patients.

According to the timing of patients seeking special-

ized care, it is known that the absolute majority of patients applied to 3 days after injury (53.0%). Out of 36 patients, 15 (41.6%) had concomitant diseases – mainly elderly and senile people. The remaining part of the patients - young and middle-aged persons turned out to be somatically healthy.

Basically, X-ray was more usable, we used CT in 45% of cases, because the CT machine is the only one in the clinic, and was constantly loaded during the pandemic period.

All patients underwent a clinical assessment of the general condition, and the state of the local status to diagnose the damage, and determine indications and contraindications for surgical treatment. It was mandatory to examine the distal parts of the upper limb, because the literature describes damage to the neurovascular bundle in patients with fractures of the proximal humerus, especially in elderly and senile people, against the background of atherosclerotic vascular lesions.

To confirm the diagnosis, when the patient with fractures of the proximal humerus was admitted to the hospital, X-rays of the shoulder joint were performed with indirect and axial projections. Performing an axial radiograph of the shoulder joint with such fractures is impossible due to the pro-

nounced pain syndrome and sharp restriction of movements in the shoulder joint. In this case, radiography of the proximal shoulder was performed in a transthoracic projection. X-ray method of investigation was also used after osteosynthesis to assess the reparative regeneration of bone tissue in dynamic observations.

The analysis of the clinical material considered gender, age, type of injury, the nature of the fracture, the method of surgical intervention, the timing from the moment of injury, the volume of intervention, complications, the timing of in-patient and outpatient treatment, the timing of the restoration of the ability to support and function of the damaged limb.

The protocol of the study was approved by the Local Ethics Commission of the Kazakh National Medical University named after S.D. Asfendiyarov, registration No. 1047 dated 02/24/2020, developed in accordance with the ethical principles of the Helsinki Declaration. Informed consent was obtained from all participants of the study.

Results

The results of surgical treatment were evaluated according to the scheme of E.R. Mattis [35], this scheme is universal and can be used to study the outcomes of treatment of the proximal humerus. The system includes 16 indicators evaluated on a 5-point scale, the last indicator (restoration of limb function) is evaluated on a 25-point scale. A comparative analysis of the outcome of treatment of patients of both clinical groups is presented in Table 3.

Table 3 –Results of surgical treatment of patients with fractures of the proximal humerus.

Treatment outcomes	Number of patients
Excellent	
Number of patients	14
Frequency in %	38,9
Good	
Number of patients	11
Frequency in %	30,6
Satisfactory:	
Number of patients	6
Frequency in %	16,7
Unsatisfactory:	
Number of patients	5
Frequency in %	13,8
Total	36
	(100,0%)

The frequency of excellent treatment results was 38.9%, while that of good was - 30.6% of cases. Such high results were achieved due to the properties of locking plates with angular stability of screws, providing stable synthesis and early rehabilitation of

patients. The frequency of satisfactory treatment results in 6 patients was 16.7%, which was statistically significant.

Cases complicated by shoulder joint contracture also led to an increase in the number of patients with satisfactory results. It should be noted that in one patient (2.7%) with a type B3 fracture, grade 2 adductor contracture of the shoulder joint developed as a result of impingement syndrome due to the high position of the plate, in another patient (2.7%) - due to varus displacement of the head of the humerus. Unsatisfactory treatment was recognized in 5 (13.8%) patients. Moreover, in 2 (5.5%) patients with fractures of type B3, C2, impingement syndrome was observed, combined with varus collapse of the head and persistent contracture of the shoulder joint. 2 (5.5%) patients developed avascular necrosis of the head of the humerus, an improperly fused fracture with adduction contracture of the shoulder joint with the migration of screws into the joint. In 1 (2.7%) patient with a type C2 fracture, on the background of an improperly fused fracture due to varus deformation, a contracture of the shoulder joint of the 2nd degree was formed. Thus, the treatment of patients with the proximal humeral bone using locking plates with angular stability of screws provided excellent and good treatment results in 69.5%, and satisfactory results in 16.7%. Unsatisfactory treatment results were 13.8%.

Discussion

According to various authors, the frequency of complications after osteosynthesis of fractures of the proximal humerus having a plate with angular stability of screws ranges from 13.7 to 33.5% [21,22,23,24,25,12]. The authors refer to the following complications: impingement syndrome, screw migration, avascular necrosis, varus displacement, neurological lesions, plate fractures, inadequate fixation, and infection [22,23,24,25]. According to Fankhauser F., *et al.*, and [12] Duralde X., *et al.*, [25] such complications may not only be the result of a violation of surgical technique of implant placement and improper selection of metal structures but also the nature of damage, including osteonecrosis, osteoporosis, pathology of bone regeneration.

Impingement syndrome

Among our patients, impingement syndrome was observed in 3 (8.4%) cases, and in 2 (5.5%) cases due to the high location of the plates (while the distance to the tip of the large tubercle was less than 3 mm) and in 1 (2.6%) case due to varus collapse of the head.

Varus deformity of the humerus

In our observation, varus deformity of the proximal humerus was observed in 6 (16.7%) cases. Moreover,

the cause of such a complication was irregularly grown fractures of type C2 (four-fragment fracture and fracture-dislocation) in 4 (11.0%) cases. Incomplete reposition of B3, C2 fractures (three- and four-fragment fractures) with impingement syndrome, avascular necrosis in 2 (5.5%).

In 2 (5.5%) clinical observations, avascular necrosis of the head of the humerus with the fragmentation of bone structures, and varus deformation, with the migration of screws into the joint in one case was revealed in patients with a four-fragment fracture and fracture-dislocation older than 65 years in the long-term period of injury.

Penetration of screws into the shoulder joint

According to researchers, the penetration of screws into the shoulder joint is observed from 14 to 16%, as a result of damage to the subchondral plate, and the migration of screws [34,35,49]. According to Sproul *et al.*, [37] the frequency of this complication is 7.5%, and other authors - up to 23% [49]. In our studies, such a complication was observed in one 1 (2.7%) case in a patient with a shoulder fracture-dislocation. This complication still affected the long-term result of treatment. Despite the fusion of the fracture, the patient developed avascular necrosis of the caput of the humerus in the long-term period after osteosynthesis. As a rule, such errors are eliminated by surgery intraoperatively. Primary and secondary penetration into the shoulder joint is known. Primary penetration is observed with intraoperative insertion of screws. Secondary penetration is considered when the screw is lobbed due to the varus displacement of the shoulder head, migration of the metal structure [38]. According to the researchers, secondary screw ingestion was more often observed in the elderly as a result of osteoporosis [39]. According to Thanasas *et al.*, [40] incorrect selection of the size of the fixing screw

is the most common intraoperative error. The proportion of such a complication ranges from 2 to 17.9% [20]. To prevent such a complication, some researchers recommended installing screws at a distance of 2-3 mm from the subchondral plate [41,3,37], others at a distance of 5- 10 millimeters from the joint surface [25]. According to Spross *et al.*, [25], when installing screws at a distance of 4-5 mm from the subchondral bone, complications associated with intra-articular penetration of screws significantly decreased. A decrease in this complication was observed with the use of bone cement [42]. According to Voigt *et al.*, [43] the polyaxial arrangement of interlocked screws with blunted ends may be useful if their twisting occurs.

Conclusions

The treatment of our patients with fractures of the proximal humerus using locking plates with angular stability of screws provided excellent and good treatment results in 69.5% with full restoration of the volume of movements of the shoulder joint, in 16.7% - a satisfactory result. Unsatisfactory treatment results were 13.8%, the frequency of postoperative complications was 19.4%. Performing stable osteosynthesis of fractures of three-four-segment fractures and fractures-dislocations of the shoulder with the help of locking plates with angular stability of screws is a technically complex operation. The study of our material and our brief review of the literature showed that the frequency of complications after osteosynthesis of the shoulder with a blocked plate is associated not only with the complexity of the surgical technique of implant placement but also with the nature of the damage, including osteoporosis, osteonecrosis, pathology of bone regeneration.

Conflict of interest

The authors declared no sources of financial support or conflict of interest.

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Original Article

Pattern of cutaneous neoplasms and associated factors at a tertiary teaching hospital pathology center in Ethiopia: An eight-year histopathological review

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Abstract

Background: Cancer is the leading cause of death globally and is on the rise in Africa. Cutaneous neoplasms are becoming increasingly common worldwide. Understanding the pattern of this disease is essential for developing data-driven preventive, screening, and treatment services. However, there are limited studies in Ethiopia so far. Therefore, the study aimed to assess the pattern and associated factors of cutaneous neoplasm among patients with histopathologically confirmed biopsy results at a tertiary teaching hospital in Ethiopia from March 2014 to October 2022.

Methods: A retrospective record review study was conducted among 1006 patients with histopathologically confirmed cutaneous neoplasms from the biopsies that were assessed at St. Paul's Hospital Millennium Medical College. Data was summarized using frequencies, percentages, median (interquartile range), and graphs. To identify significant factors associated with malignant cutaneous neoplasm, a multivariable binary logistic regression model was fitted, where Adjusted Odds ratio (AOR), 95% CIs for AOR, and p-values were used for interpretation of results.

Result: From the 1006 cases, 265 (26.3%, 95%CI=23.5%-29.3%) were malignant, of which sarcoma (26.0%) and squamous cell carcinoma (25.7%) were the most frequent and found to be prevalent in younger (19-29 years) and older (≥ 60 years) patients, respectively. The trunk was the commonest site (54.2%) for all the malignancies, especially sarcoma (80.4%). Age was found to be a significant exposure that is associated with the development of malignant cutaneous neoplasm for those ≥ 30 years as compared with those ≤ 18 years, with the odds increasing with age (AOR=2.66, 95% CI=1.10, 6.45 for 30-39 years, AOR=4.98, 95% CI= 2.01, 12.36 for 40-49 years, AOR=5.33, 95% CI=2.15, 13.22 for 50-59 years and AOR= 6.62, 95% CI=2.79, 15.66 for ≥ 60).

Conclusion: The prevalence of malignant cutaneous neoplasm is higher than previously reported in the country and the malignancy pattern and distribution are different from what is known so far. This could signal a shift in disease epidemiology, and the findings should be factored into clinical decision making and program design for disease prevention, screening, and treatment. It also calls for further prospective research to learn more about the conditions in the context of additional relevant personal and clinical characteristics

Keywords: Cutaneous neoplasm, Histopathology, Ethiopia

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Background

Neoplasms are abnormal tissue growths that continue to grow in the absence of external stimuli. They can be benign, in which the growth does not invade nearby tissues or other parts of the body, or malignant (also called cancers), in which the growth can invade nearby

tissues and has the potential to metastasize to other parts of the body via the blood and lymph systems [1-3].

According to the World Health Organization (WHO), cancer has long been the top cause of mor-

tality worldwide, accounting for millions of deaths before the age of 70 in most countries, with an estimated 19.3 million new cancer cases and over 10.0 million cancer deaths in 2020 [5-7]. Cancer incidence in Africa has also increased from 715,000 in 2008 to 1.1 million in 2020, and associated mortality has increased from 542,000 in 2008 to 711,000 in 2020 [8,9]. In 2019, the national burden of cancer in Ethiopia was estimated to be 53,560 new cases, 39,480 deaths, and 1.42 million disability-adjusted life years (DALYs) lost due to cancer [10]. These estimates are supported by studies undertaken at different tertiary level institutions in the country [11-16].

Cutaneous neoplasms, one type of neoplasm, are abnormal growths on the skin that can be either benign or malignant. The most common types of malignant cutaneous neoplasms are basal cell carcinoma (BCC), squamous cell carcinoma (SCC), and melanoma. Cutaneous neoplasms are among the most common forms of cancer, and the global incidence has been increasing at an alarming rate [1,17,18]. Understanding the pattern of this disease is essential for developing data-driven preventive, screening, and treatment services. However, the area is under-researched in Africa, despite the fact that many studies have been conducted around the world [9, 19-21]. In Ethiopia, there have been a few studies, but they have all focused on malignant cutaneous neoplasms. These studies have found that sarcomas account for 9.7% to 15% of all neoplasms, and SCC accounts for 8% of all cutaneous biopsy specimens [11, 12, 15, 16].

This study aims to fill this knowledge gap by examining the pattern of both benign and malignant cutaneous neoplasms in one of the largest referral tertiary hospitals in Ethiopia, which receives a large number of patients from all over the country and has a well-established pathology center. Accordingly, the study aimed to assess the pattern and associated factors of cutaneous neoplasms among patients with histopathologically confirmed biopsy results at a tertiary teaching hospital in Ethiopia between March 2014 and October 2022.

Methodology

Study Setting and Period

The study was conducted from December 2022 to February 2023 at St Paul's Hospital Millennium Medical College (SPHMMC), a tertiary teaching hospital under the Federal Ministry of Health in Addis Ababa, Ethiopia. The hospital provides both inpatient and outpatient service under different specialty and subspecialty fields to more than 5 million population under its catchment. Among its well-established wings is the Pathology center, which started service in 2014. The center is one of the few Pathology cen-

ters in the country. It archives specimens from many different other institutions and provides FNAC service for more than 7,000 patients and biopsy service for an average of 6000 patients annually.

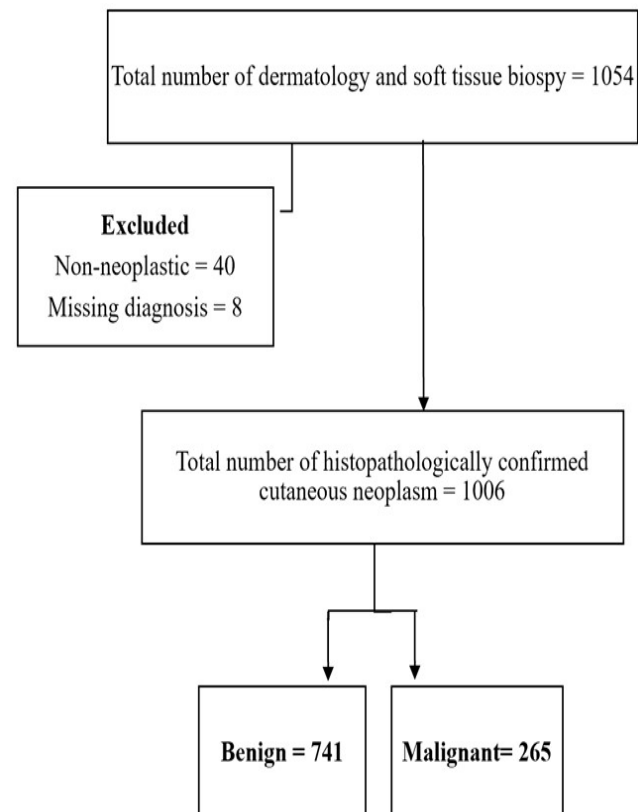
Study Design and Population

A retrospective chart review study was conducted among patients who had histopathological biopsy specimens examined at the pathology center between March 2014 and October 2022.

The source population were all patients for whom histopathological analysis of dermatology and soft tissue biopsy specimens were made at the pathology center of the hospital during the eight-year observation period. From whom, all patients with confirmed cutaneous neoplasm were the study population. From the list of the study population, patients with complete data on major demographic, clinical and histopathologic data were eligible to be included in the study.

Sample Size and Sampling

All patients with histopathologically proven cutaneous neoplasm and with complete data on age, sex and anatomic site were included in the study. During the eight-year observation period, a total of 1054 dermatology and soft tissue biopsy specimens of patients were ana-



lyzed, from which 1006 eligible patients were included in the study. (Figure 1)

Data Collection and Quality Assurance

Data was extracted from the electronic database of the Department of Pathology using a predefined data abstraction tool on the following variables: age, sex, anatomic location of the neoplasm, type of cutaneous neoplasm, and pattern of cutaneous malignancy.

Data extraction was made by two trained General Practitioners. Further data quality was assured by data cleaning through checking for inconsistencies, numerical errors, and missing parameters. Furthermore, the patients' records were referred to verify the collected data whenever discrepancies were observed. All statistical analysis was performed using SPSS version 25.0 software for analysis.

Statistical Analysis

Data was described with the proper statistical summary measures based on the nature of the variable using frequencies with percentages, graphs and median with interquartile range.

To identify factors associated with the development of malignant cutaneous neoplasm among the study participants, a binary logistic regression model was run. All the exposure variables were included in the multivariable analysis, despite their statistical level at univariate analysis, due to the clinical significance of the variables. The final multivariable model was run at 5% level of significance. To measure the presence and strength of association between the exposures and the type of neoplasm, adjusted odds ratio (AOR), 95% CI for AOR and P-value was used. Variables with p-value ≤ 0.05 were considered as significantly associated with the development of malignant cutaneous neoplasms. The adequacy of the final model was checked using the Hosmer and Lemeshow goodness of fit test and the model fitted the data well with p-value of 0.290.

Results

Sociodemographic and clinical characteristics

The median age of the participants was 35.7 years (IQR, 24.9 - 54.0), of which 121 (12.0%) were pediatric cases, and 518 (51.5%) were females. Two hundred sixty-five (26.3%, 95% CI= 23.5% -29.3%) of the cases were malignant and the rest 741 (73.7%, 95% CI=70.7% - 76.5%) were benign. (**Table 1**)

Table 1: Socio-demographic and clinical characteristics of patients (n=1006)

Variable	Frequency	Percentage
Age category (in years)		
≤ 18	121	12.0
19-29	246	24.5
30-39	196	19.5
40-49	129	12.8
50-59	119	11.8
≥ 60	195	19.4
Sex		
Male	488	48.5
Female	518	51.5
Type of neoplasm		
Benign	741	73.7
Malignant	265	26.3

From these 265 malignant cases, 212 (80%) is constituted by five malignancies; sarcoma (26.0%) and squamous cell carcinoma (25.7%) being the most frequently diagnosed malignancies followed by melanoma (12.1%), basal cell carcinoma (9.4%), and lymphoma (6.8%). Among the 69 sarcoma cases nearly half (31/69) was dermatofibrosarcoma protuberans. Pleomorphic sarcoma and leiomyosarcoma accounted for 5/69 cases each, Kaposi sarcoma was diagnosed in 4/69, and low grade fibromyxoid sarcoma was diagnosed in 2/69. The remaining 22/69 sarcomas were of different types.

From the 1006 cases, data on anatomic site of neoplasm was accessed only for 643 cases. Of these 643 cases, only 8 (1.2%) had multiple site lesions, the rest 635 (98.8%) had lesions on only one anatomic site. Accordingly, the commonest site was trunk constituting more than half (54.2%) of the cases followed by head, neck and face (22.0%), lower limb (18.4%) and upper limb (5.4%). (**Figure 2**)

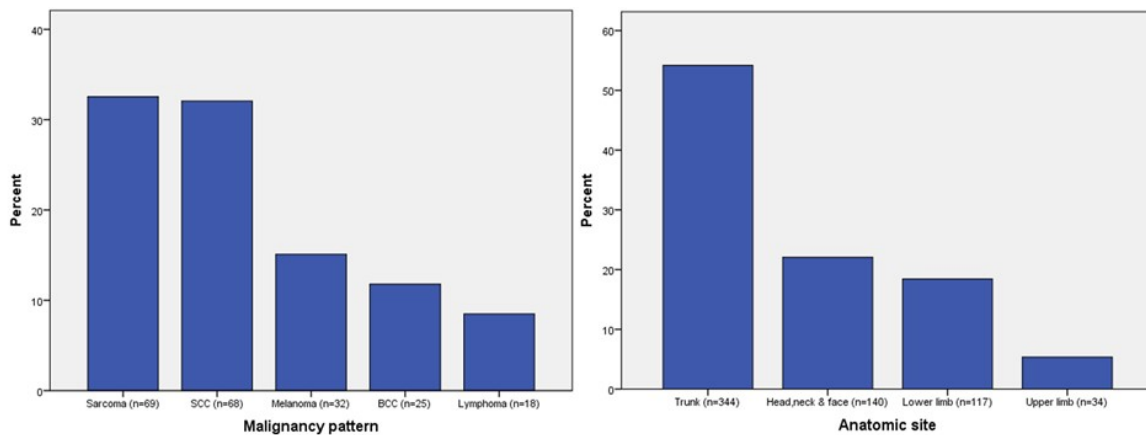


Figure 2: Malignancy pattern and anatomic site of the lesions among patients.

Distribution of common cutaneous malignancies based on age, sex and anatomic site

The distribution of the commonly identified neoplasms showed that Sarcoma was more frequently diagnosed in those younger than 60 years with the largest proportion lying between 19 and 29 years of age (30.4%). SCC, melanoma, and BCC are diagnosed in older age groups notably among those older than 60 years (64.0%, 37.5% and 41.2%, respectively). On the other hand, diagnosis of lymphoma seems to have a bi-modal pick where most diagnosed cases lie in the age range of 19 to 39 (55.5%) and older than 60 years (27.8%). The distribution of these malignancies based on sex doesn't seem to have a big difference except for SCC where almost two-third (61.8%) of cases were diagnosed in females.

Regarding anatomic sites, the majority (80.4%) of sarcoma cases were located on the trunk. SCC was comparably distributed on all sites except on the upper limb (3.9%). For melanoma, almost all cases were located on the trunk (43.5%) and lower limb (52.2%) and none on the upper limb. The most frequent site for BCC is the head, neck and face region (84.6%) and the rest 2 (15.4%) were located on the Trunk. All cases of lymphoma were on the trunk (40.0%) and limbs (40.0% on upper limb and 20.0% on lower limb). (**Table 2**)

Table 2: Distribution of the common cutaneous malignancies based on age, sex and anatomic site.

Variable	Type of cutaneous malignancy				
	Sarcoma (n=69)	SCC (n=68)	Melanoma (n=32)	BCC (n=25)	Lymphoma (n=18)
Age category (n=212)					
≤ 18	9 (13.0%)	0	1 (3.1%)	0	1 (5.6%)
19-29	21 (30.4%)	2 (2.9%)	2 (6.3%)	0	4 (22.2%)
30-39	9 (13.0%)	11 (16.2%)	7 (21.9%)	1 (4.0%)	6 (33.3%)
40-49	14 (20.3%)	12 (17.6%)	6 (18.8%)	5 (20.0%)	2 (11.1%)
50-59	10 (14.5%)	15 (22.1%)	4 (12.5%)	3 (12.0%)	0
≥ 60	6 (8.7%)	28 (41.2%)	12 (37.5%)	16 (64.0%)	5 (27.8%)
Sex (n=212)					
Female	29 (42.0%)	42 (61.8%)	18 (56.3%)	11 (44.0%)	8 (44.4%)
Male	40 (58.0%)	26 (38.2%)	14 (43.8%)	14 (56.0%)	10 (55.6%)
Anatomic site (n=143)					
Head, neck, and face	5 (9.8%)	20 (39.2%)	1 (4.3%)	11 (84.6%)	0
Trunk	41 (80.4%)	17 (33.3%)	10 (43.5%)	2 (15.4%)	2 (40.0%)
Upper limb	1 (2.0%)	2 (3.9%)	0	0	2 (40.0%)
Lower limb	4 (7.8%)	12 (23.5%)	12 (52.2%)	0	1 (20.0%)

Factors associated with type of cutaneous neoplasm (benign Vs malignant)

To identify factors that affect the type of cutaneous neoplasm, a binary logistic regression model was applied. Multivariable analysis was run at 5% level of significance to identify if the exposures are significantly associated with the diagnosis of malignant cutaneous neoplasm.

Accordingly, age group was found to be the only exposure that is significantly associated with the outcome. After adjusting for sex and anatomic site, the

odds of developing malignant cutaneous neoplasm showed a significant increase for those 30 years and older as compared with those 18 years and younger. The increase was higher with increase in age with almost a triple increase among those 60 years and older (AOR= 6.62, 95% CI= 2.79, 15.66, $p<0.0001$) as compared to those 30-39 years old (AOR= 2.66, 95% CI= 1.10, 6.45, $p=0.03$). On the other hand, patients 19-29 years old didn't show a statistically significant increased odds of developing malignant cutaneous neoplasm as compared with those 18 years and younger. (Table 3)

Table 3: Factors associated with development of malignant cutaneous neoplasm (n=635).

Variable	Type of malignancy		COR (95% CI)	AOR (95% CI)	p-value
	Benign	Malignant			
Age category					
≤ 18	58	7	1	1	<0.0001*
19-29	120	28	1.93 (0.79, 4.69)	1.89 (0.78, 4.61)	0.158
30-39	99	32	2.68 (1.11, 6.46)	2.66 (1.10, 6.45)	0.03*
40-49	51	30	4.87 (1.97, 12.04)	4.98 (2.01, 12.36)	0.001*
50-59	48	31	5.35 (2.17, 13.23)	5.33 (2.15, 13.22)	0.000*
≥ 60	74	57	6.38 (2.71, 15.04)	6.62 (2.79, 15.66)	0.000*
Sex					
Male	224	84	1	1	
Female	226	101	1.19 (0.85, 1.68)	1.33 (0.93, 1.91)	0.117
Anatomic site					
Head, neck, and face	95	45	1	1	0.413
Trunk	244	100	0.87 (0.57, 1.32)	0.86 (0.55, 1.34)	0.495
Upper limb	28	6	0.45 (0.18, 1.17)	0.46 (0.18, 1.23)	0.122
Lower limb	83	34	0.87 (0.51, 1.48)	0.75 (0.43, 1.30)	0.301

Note: COR, Crude Risk ratio; AOR, Adjusted Risk ratio; CI, Confidence interval; *statistically significant

Discussion

The study was conducted among 1006 patients with histopathologically confirmed cutaneous neoplasms with the aim of assessing the pattern and associated factors of cutaneous neoplasm. Among the total cases, 265 (26.3%, 95% CI= 23.5% -29.3%) of the cases were malignant and the rest 741 (73.7%, 95% CI=70.7% - 76.5%) were benign. The prevalence of malignant cutaneous neoplasms in our study appears to be close to that of another study conducted in Ethiopia, which reported a frequency of 22.0%. However, it is higher than studies from another regional institution in Ethiopia, where a frequency of 4.06% was reported, and Nigeria, where a prevalence of 12.7% was reported [14,15, 19].

The study revealed that sarcoma (26.0%) and SCC (25.7%) were the most frequently diagnosed malignancies followed by melanoma (12.1%), BCC (9.4%), and lymphoma (6.8%). Among the 69 sarcoma cases, near-

ly half (31/69) were dermatofibrosarcoma protuberans. This is in contrast to most data from Ethiopia, where SCC is the most frequent form of cutaneous malignancy, accounting for about half of all cases [12, 14-16]. Similarly, a study conducted in Kenya found SCC to be the most frequent cutaneous malignancy, accounting for 45% of all cases [20]. Furthermore, the study showed that the commonest anatomic site was the trunk constituting more than half (54.2%) of the cases followed by head, neck and face (22.0%), lower limb (18.4%) and upper limb (5.4%). This is also in contrast to previous findings where lower limb is reported to be the commonest site of cutaneous neoplasm accounting for nearly half of the neoplasms [12, 20].

The difference in the frequency and pattern of malignant cutaneous neoplasms seen in this study as compared to previous researches could be attributed to the following factors: the nature of the institution where the study was conducted, which receives more

serious cases that require better medical attention from all over the country, the potentially increased healthcare-seeking behavior of the population in recent years, and a probable change in disease epidemiology due to continuously changing lifestyle and climate change. In addition, the equal prevalence of sarcomas and SCC in our study could be due to the higher submission rate of soft tissue biopsies as compared to skin biopsies based on routine observation. However, this could not be objectively demonstrated as the tissue samples are not submitted as soft tissue and skin separately.

On the regression analysis, age was found to be a significant exposure that is associated with the development of malignant cutaneous neoplasm for those 30 years and older as compared with those 18 years and younger with the odds increasing with age. This is an expected pattern as it is known that the risk of any cancer increases with age due to cellular damage accumulation, weakened immune system, less healthy stem cells, and changes in metabolism. This finding is also in line with previous studies conducted in comparable settings [12,20].

The findings of this study add a significant contribution to the current literature by providing an updated finding from a large referral hospital with a large sample of participants from all over the country over an eight-year period. However, due to a lack of queries in the pathology patient reception chart, data on additional relevant personal and clinical information were not included in the study.

Conclusion

The study's findings show that the prevalence of malignant cutaneous neoplasm is higher than previously reported in the country. Furthermore, the malignancy pattern and distribution are different from what is known so far. This could signal a shift in disease epidemiology, and the findings should be factored into clinical decision making and program design for disease prevention, screening, and treatment. It also calls for further prospective research to learn more about the condition in the context of additional relevant

personal and clinical characteristics.

Declaration

Ethical Considerations: The study was conducted after securing ethical clearance from St. Paul's Hospital Millennium Medical College institutional review board (SPHMMC-IRB). Since the study used secondary data, waiver of consent was also obtained from the SPHMMC-IRB. Medical record number was used for the data collection and personal identifiers of the patient were not used in the research report. Access to the collected information was limited to the research team and confidentiality was maintained throughout the project.

Availability of data and materials: All relevant data are available upon reasonable request.

Competing interests: The authors declare that they have no known competing interests.

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Original Article

Association between medication adherence in patients with type 2 diabetes with their quality of life: A cross-sectional study

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Abstract

Background: Assess the impact of medication adherence on quality of life (QOL) in patients with type 2 diabetes in different setting and societies, can be considered as a great clinical importance. Therefore, this study was designed for evaluation of association between medication adherence in patients with type 2 diabetes with their QOL.

Methods: This cross-sectional study was conducted on 279 diabetic type 2 positive cases referred to Endocrinology clinic in Hamadan City at the first six months of 2020. The short-form health survey SF-36 and MMAS-8 questionnaire was used for assessing health related QOL and medication adherence of patients, respectively. Correlations between each QOL domain with medication adherence were tested with Pearson's *r* coefficient.

Results: Among investigated patients, 154 (55.2%) of them were male and vast majority were urban dweller (91.07%). The number of 101 patients (36.07%) had high treatment adherence. We found a significant and positive correlation between medication adherence and domains of emotional wellbeing, social functioning, general health and total score of QOL ($P > 0.05$). While there was a significant negative correlation between medication adherence and role limitations due to physical health ($r = -0.14$, $P = 0.02$).

Conclusion: Based on the findings of this study, diabetic patients with poor QOL may have less medication adherence, then such patients should be integrated e.g. in self-care education programs and reinforcement interventions to improve QOL and medication adherence.

Keywords: Medication Adherence, Quality of life, Diabetes

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Introduction

Following the industrialization of countries in the 21st century, increasing life expectancy and lifestyle changes, the pattern of diseases has changed from acute to chronic such as diabetes mellitus (DM) (1). DM is the most prevalent metabolic disorder worldwide, described by the chronic form of hyperglycemia and resulted from a deficiency in insulin secretion or action or both (2). There are currently more than 415 million people lived with diabetes worldwide (3). Diabetes is responsible for 4 million deaths every year (9% of all deaths) (4). It is predicted that the prevalence of DM increase by 69% in less advanced countries until 2030 (5). The prevalence of diabetes in Iranian men and women is 8% and 10%,

respectively (6). The most prevalent type of DM is type 2 diabetes and affects about 90-95% of all people with diabetes (7). It is one of the major health problems in human life, because of the high prevalence, high cost of treatment as well as due to its severe disability (8, 9). This disease also affect the patient and their family quality of life (QOL) due to its multi organ involvement and chronic nature. The lower QOL has been reported with increased disease severity (5). Quality of life is a multidimensional fundamental factor and a combination of cognitive (satisfaction) and emotional (Happiness) factors. Therefore, the aim of the medical cares should be to improve the quality of life

(5). Self-management has been considered as the basis of success of long-term maintenance cares and prevention of disease comorbidities. Proper diet, physical activity and adherence to drug therapies (medication regimen) are among the self-management behaviors of patients with diabetes (4). Adherence to the medication regimen is defined as taking the prescribed drugs at the correct time and amount during the prescribed period (10).

The clinical effect of drug therapies for diabetic patients has been limited by low adherence behavior (11). The World Health Organization (WHO) has estimated that adherence behavior in diabetic patients for long-term maintenance in less advanced countries is only 50%, and even lower in developing countries (12). Results of the systematic review study showed that adherence to insulin therapy in patients with Type 1 or Type 2 diabetes mellitus was vary widely from 43% to 86% in different studies (13). The discontinuation rates of the drug use in a 30 days period of treatment reached 42% and injectable drugs of diabetes mellitus had the higher risk for discontinuation rather than oral medications (14). Generally, the incidence of non-adherence to drug therapies in diabetic patients is high due to the long length of treatment duration (15).

Low adherence to diabetes drugs regimen leads to treatment failure, damage to vital organs (such as kidneys), imposing financial cost to the patients and their family, lower quality of life and finally increased mortality (16).

It has been reported that patient's features like age, sex, education, income, history of disease in their family, duration of diabetes mellitus, and prescribed treatments could affect patient's quality of life. Also, some prescribed drugs can negatively affect the diabetes mellitus patient's quality of life (10, 17). The results of studies regarding the relation between quality of life of DM patients and adherence to drug treatment and glycemic control was not necessarily a significant relationship (11, 18, 19). We think some of these discrepancies may be due to the ignoring confounding factors and different instruments or methods used to measure diabetic patients QOL and adherence to drug treatment. Therefore, this study was designed for evaluation of association between medication adherence in patients with type 2 diabetes with their quality of life.

Material and Methods

Study design and setting

In this cross-sectional study, a total of 279 individuals with type 2 diabetes referred to Endocrinology clinic affiliated to Hamadan University of Medical Sciences, Hamadan City, Hamadan Province, Iran, in the first six months of 2020 were enrolled. This is a referral center for diabetic patients in Hamedan province, which provides diagnostic and treatment services to

patients by an endocrinology specialist. Additionally, nutritional services are provided by a nutritionist in this center. Since we were not aware of the population frame of patients and the pattern of patient referrals, we had no choice but to use non-probability sampling methods for choosing patients. We obtained oral informed consent from the patients.

Eligibility criteria

To enter the study, at least six months must have passed since the patient was diagnosed with diabetes, and the patient must be willing to contribute in the study. Illiterate patients, patients with neurological diseases or with other known co-morbidities were omitted from the study.

Data collection tools

We used a researcher-made checklist for gathering demographic variables of the patients including: gender, age, marital status, location and education.

The Iranian version of the health survey SF-36 in the short form was used to evaluate the health related quality of life in diabetic patients (20). The validity and reliability of this instrument was approved in previous studies (20). This questionnaire consists of 36 items with 8 domain including: general health (5 items), physical functioning (10 items), role limitations due to physical problems (4 items), social functioning (2 items), pain (2 items), energy/ fatigue (4 items), role limitations due to emotional problems (3 items) and emotional well-being (5 items). Each domain ranged from 0-100 scale, with higher scores representative better situation (21).

The Persian version of MMAS-8 was used for determine medication adherence of patients. Items 1 -7 are binary (yes/no) and item 8 has a five-point in the Likert response scale. "Yes" response to questions 1-7 is scored as 1 and "no" is scored as 0. About the item 8, to compute a summated score, the scores (0-4) be standardized by dividing the result by 4. Total scores for this questionnaire is ranged from 0 to 8, with scores of 8, 7 or 6 and <6 indicating high adherence, medium adherence and low adherence, respectively (3). The validity and reliability of the questionnaire to use in Iranian context has been approved in previous studies (22, 23).

Data collection procedures

The data collection process involved asking patients questions by a trained nursing specialist before their visit with the physician or nutritionist. Additionally, some information was extracted from the patient's care and treatment records. The final questionnaire check was performed by the physician who is based at the center.

Statistical Methods

Descriptive statistics including mean and SD for quantitative data and n (%) for qualitative data were used for describe demographic features of type 2 diabetic patients, and their medication adherence and quality of

life status. The normality assumption of the variables distribution was checked with shapiro-wilk test. An independent Student's t test was used for comparison the means of treatment adherence and quality of life, an analysis of variance (ANOVA) was used for comparison the means of medication adherence and quality of life according variables with more than two categories. Correlations between each quality of life domain with medication adherence were tested with Pearson's r coefficient. Data were analyzed using Stata- 14 software. Significant level was considered at the 5 % level ($p < 0.05$).

Ethical considerations

We obtained oral informed consent from the patients for participation to the study. The study has been approved by the Ethics Committee of Hamadan University of Medical Sciences (Ethics code: IR.UMSHA.REC.1398.620).

Results

In total 279 diabetic patents were investigated. 154 (55.2%) of them were male and vast majority of them were urban dweller (91.07%). In regards of their edu-

cation and marital status, 132 (47.14%) had academic education and 239 (85.36%) were married. About half of them were in the age range of 54-60 years and 37 (13.21. %) were under 45 years old. 101 (36.07%) of the patients had high treatment adherence and in 87 (31.07%) of them medication adherence was low.

The relation between medication adherence and quality of life according demographic variables is shown in table 1. As shown, there was not a significant association between patient's demographic characteristics and their treatment adherence status ($P > 0.05$). While, males had reported higher score of quality of life compared women ($P = 0.008$), and increasing the level of education was associated with increasing the quality of life ($P < 0.001$). Also there was a significant association between marital status and quality of life (49.58 for married vs. 45.54 for single patients, $P = 0.009$). With increase in the age of patients, their quality of life has decreased significantly ($P = 0.03$).

Table 1. Medication adherence and quality of life by demographic variables

Variable	Total (%)	Medication adherence status (<6: poor, 6-7.9: moderate, 8: good)			Quality of life (SF35 score)				
		Poor 87 (31.07)	Moder- ate 92 (32.86)	Good 101 (36.07)	Mean (SD)	P*	Mean (SD)	p	
Gender	Male	125 (44.8)	40 (31.75)	45 (35.71)	41 (32.54)	6.38 (1.67)	0.21	50.61 (8.96)	0.008**
	Female	154 (55.2)	47 (30.52)	47 (30.52)	60 (38.96)	6.61 (1.47)		47.69 (9.24)	
Educa- tion	Illiterate	56 (20)	21 (37.5)	15 (26.79)	20 (35.71)	6.46 (1.51)	0.31	45.31 (9.92)	<0.001* **
	Diploma and less Academ- ic	92 (32.86)	22 (23.91)	34 (36.96)	36 (39.13)	6.71 (1.34)		48.32 (9.22)	
Marital status	Single	41 (14.64)	15 (36.59)	13 (31.71)	13 (31.71)	6.37 (1.6)	0.54	45.54 (7.75)	0.009**
	Married	239 (85.36)	72 (30.13)	79 (33.05)	88 (36.82)	6.53 (1.56)		49.58 (9.33)	
Age group (year)	30-44.9	37 (13.21)	16 (43.24)	12 (32.43)	9 (24.32)	6.09 (1.55)	0.12	52.2 (8.06)	0.03***
	45-59.9	137 (48.93)	37 (27.01)	55 (40.15)	45 (32.85)	6.47 (1.62)		49.81 (8.91)	
	60+	106 (37.86)	34 (32.08)	25 (23.58)	47 (44.34)	6.7 (1.48)		46.84 (9.55)	
Loca- tion	Urban	255 (91.07)	79 (30.98)	83 (32.55)	93 (36.47)	6.52 (1.57)	0.69	49.04 (8.83)	0.72**
	Rural	25 (8.93)	8 (32)	9 (36)	8 (32)	6.39 (1.54)		48.34 (12.7)	

*Chi- square test, ** student t-test, *** One way ANOV

The mean scores for domains of the quality of life was ranged from 11.79 in the role limitations due to emotional problems domain to 79.74 in the social functioning domain. The total mean (SD) score of quality of life for patients was 48.98 (9.22) (**Table 2**).

Table 2. Quality of life components mean score of the study population

SF36 domains	Range	Mean (SD)
Physical functioning	0, 100	69 (28.17)
Role limitations due to physical health	2.5, 100	16.78 (26.04)
Role limitations due to emotional problems	1.33, 100	11.79 (19.88)
Energy/ fatigue	10, 90	45.28 (19.05)
Emotional well being	8, 88	58.2 (18.17)
Social functioning	12.5, 100	79.74 (20.44)
Pain	0, 100	76.53 (28.16)
General health	0.4, 62	34.99 (14.76)
SF36, total score	13.38, 69.37	48.98 (9.22)

The correlation between medication adherence of patients and domains of quality of life is shown in table 3. There was a significant positive correlation between medication adherence and domains of emotional wellbeing, social functioning, general health and total score of quality of life ($P>0.05$). While there was a significant negative correlation between medication adherence and role limitations due to physical health ($r=-0.14$, $P=0.02$).

Table 3. Correlation between medication adherence and domains of quality of life

Medication adherence		
SF36 domains	r*	p
Physical functioning	0.04	0.54
Role limitations due to physical health	-0.14	0.02
Role limitations due to emotional problems	-0.09	0.14
Energy/ fatigue	0.09	0.13
Emotional well being	0.18	0.003
Social functioning	0.22	<0.001
Pain	0.2	<0.001
General health	0.16	0.006
SF36, total score	0.18	0.003

*Pearson correlation coefficient

Discussion

The aim of the present study was to detect some socio-demographic determinants of treatment adherence and QOL in type 2 diabetes patients. Moreover, we examined the correlation between medication adherence and QOL. In the present study, no association between studied socio-demographic determinants and medication adherence was found while, male patients, well-educated patients, those were married and were younger had a higher score of QOL. We also found a positive correlation between medication adherence and overall QOL.

Since the rate of non-adherence to medications is reported lower than 50% among patients with type 2 diabetes in some previous studies in Iran (24, 25), it is needed to pay attention to the determining factors of medication adherence patients with type 2 diabetes is obvious. In the present study, we found that there was no socio-demographic difference in medication adherence. However, other studies have demonstrated that several factors including education level, type of medication, age, body mass index, the presence of complications, treatment duration, perceived side effect and negative effect of medicines, lack of finances and stage of diabetes may be associated with medication adherence in patients with type 2 diabetes (24, 26-30). Another point that can be mentioned is that other type of adherence in type 2 diabetes patients e.g. exercise, blood test and foot care could be modified by type of treatment. For example, in the study by Zioga et al. (31), they found that the type of treatment (diet, oral medication and insulin) is associated with adherence to blood tests.

In the line of previous studies (32-37), our results have shown that older age patients, women, those with lower education level and singles had a lower score of QOL. Other important sociodemographic characteristics that reported as determinants of QOL and not studied in the present study were income and occupation e.g. unemployment patients (34) and those with lower household income per month (33) had a lower level of overall QOL and domains of QOL. Regardless of sociodemographic characteristics, the factors including exercise, the presence of complications, comorbidities, duration of disease, psychological disorders and diet were also suggested as determinants of QOL in type 2 diabetes patients (38).

The results from previous studies showed tendency toward a positive association (5, 10, 29, 31, 39), however, some studies reported a no association between two aforementioned variables (11, 40). Heterogeneity in the reported association in previous studies may be as results of several factors e.g. type of method for medication adherence and QOL assessment. For example, in the studies that reported a positive association, medication adherence was evaluated using the

methods such as MMAS (5) Brief Medication Questionnaire (BMQ) (10), frequency of statin use (39), Diabetes Self-Care Activities Questionnaire (31) and Diabetes Self-Care Activities Questionnaire (29). In the studies that showed no association, the medication adherence was assessed using the methods such as pill counting (11) and hemoglobin A1c (HbA1c) (40).

Most studies used non-specific tools to measure QOL e.g. WHO Quality of Life (WHOQOL) (11, 39, 41), SF36 (29, 31), EQ-5D (42, 43) when evaluating the association between QOL and medication adherence while some used a diabetes-specific-QOL e.g. Diabetes 39 instrument (5) and Diabetes Quality of Life Clinical Trial Questionnaire (DQLCTQ) (10). In the present study, we used SF36 for QOL assessment and our results showed the positive statistical correlation between medication adherence and QOL domains including physical functioning, emotional well-being, social functioning, pain and general health. In other hands, the negative correlation between medication adherence and physical role as well as no statistical association between medication adherence and QOL domains including physical functioning, physical role and energy/fatigue were found. In a study by Marinho et al. (29), they used SF36 to measure the quality of life and their results suggested that SF-36 emotional domain was also associated positively related to better general medication adherence. In other work (31) suggested that an association between all domains of QOL and all adherence subscales including diet, physical activity, blood sugar test, care of feet and commendations for self-care. In another study by Perwitasari et al (10), they used DQLCTQ a specific tool for QOL assessment in diabetic patients and their results showed that beliefs, recall, and beliefs about adverse event screens as a QOL domain is related positively to medication adherence. In the study by Khayyat et al (44), the mean level of overall QOL and all QOL domains among adherent's patients with diabetes and hypertension was higher than those in non-adherent patients group.

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There are several limitations to this study. First, the temporal relationship between medication adherence and QOL with a 1-time measurement of them could not be established and this is an intrinsic limitation of a cross sectional study. For example, in one work (44) medication adherence was studied as an independent predictor of QOL while in another study (29) QOL domains were introduced as important determinants of medication adherence in patients with type 2 diabetes. Second, the impact of self-report response bias on the observed results should be considered. Third, several inclusion criteria were considered which may reduce generalizability and external validity of this study, e.g. the results may be not applied to illiterate patients. Fourth, it was not possible to measure potential confounders in the causal chain of QOL-medication adherence. For example, depression was not measured in this study which is a determinant for both QOL and medication adherence. (45, 46).

In conclusion, our results show an association between medication adherence and overall QOL and some QOL domains. Based on the findings of this study, diabetic patients with poor QOL may have less medication adherence, then such patients should be integrated e.g. in self-care education programs and reinforcement interventions to improve QOL and medication adherence. Further large-scale longitudinal studies with a bigger dataset are recommended.

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Conflict of interest

The authors declare that there is no conflict of interests.

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Systematic Review

Topics and Users' Emotions on Social Media Regarding the COVID-19 Vaccine: A Systematic Review

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Abstract

Background and Aim: Since the Coronavirus Disease 2019 (COVID-19) pandemic prevailed globally, followed by the provision of its vaccine, social media users worldwide have come to discuss the issue and exchange views accordingly. It seems highly important to understand the nature of the content that users discussing the COVID-19 vaccination regarding the community's general health. Therefore, this systematic review was designed to evaluate the issues and emotions of users on social media regarding the COVID-19 vaccine.

Material and Methods: The research data of this systematic review were extracted from the onset of the COVID-19 until November 20, 2021, by employing a proper search strategy in PubMed, Scopus, and Web of Science databases. The original research articles published in English consistent with the study objective were considered the research inclusion criteria. The authors excluded all short articles, letters to the editor, conference proceeding, review articles, and papers whose full texts were not available.

Results: The results revealed that most of the users' expressed emotions about the vaccine on social media were positive or neutral, and there were few negative emotions. The most frequent topics in posts and comments shared by social media users included safety and effectiveness, vaccine development and its speed, prevention policies, and health and political authorities.

Conclusion: Nowadays, social media can help understand attitudes and behaviors during a public health crisis and promote health messages. Accordingly, it appears crucial to get aware of people's perspectives on social media platforms to assist in designing communication strategies for health policymakers.

Keywords: Vaccine, Vaccination, Social media, Emotions, COVID-19.

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Introduction

The Coronavirus Disease 2019 (COVID-19) emerged as an infectious-epidemic disease in Wuhan, China. Since then, the disease has spread in China and other parts of the world (1) and has infected many people worldwide, with a high mortality rate left behind (2). Therefore, the COVID-19 pandemic was announced as a threat to the health of all people in the world (2, 3). Besides the risk of death, COVID-19 has been associated with numerous health, economic, social, and political consequences for all countries (1, 3, 4), and public health measures taken to reduce its effects in various countries have brought huge burden and costs on the relevant governments (5). In the mean-

time, the vaccine was introduced as a core and effective solution to prevent COVID-19 (2, 3). Since several vaccines were made available for clinical evaluation, vaccine acceptance by the general public appeared highly important in implementing the vaccination plans among individuals. For instance, the diversity of vaccines may confuse people concerning their safety and effectiveness, leading ultimately to their distrust in the process (2, 3). Doubt about the vaccination plan, defined as a delay in accepting or refusing the vaccine despite its availability, has been announced by the World Health Organization (WHO) as one of the biggest threats to global health (2, 3). According to two surveys conducted in the United States and Canada, 23%

and 76.9% of people were willing to receive COVID-19 vaccines in these countries, respectively (2).

The activity of people on social media such as Facebook, Twitter, and YouTube increased with the global spread of COVID-19; therefore, social networks provided a platform for the development and dissemination of health information (5, 6). On the other hand, the increased number of users in social media has directly influenced their role and effectiveness in shaping public opinions in different social, economic, and political contexts. Therefore, COVID-19, as one of society's special conditions and involvements, cannot be an exception (4). Accordingly, the social media act as a vital communication channel regarding COVID-19. Users on social media show interest in sharing and following their personal experiences, views, and concerns with others (7, 8). The privilege of freedom of speech and sharing of information and data among individuals, regardless of the facts, may provide the ground for sharing incorrect information followed by forming false knowledge among people (9). The repeated use of social media, along with over-reliance on such media as a source of information during the COVID-19 pandemic, has been proven by studies to increase false and wrong views among people and decline participation in preventive health behaviors (5, 10).

According to previous research, the information shared on social media may present a two-way aspect. In other words, such information can be released by reliable and official sources, or in contrast, it may be shared by unreliable and unofficial sources. Therefore, the quality and reliability of the content shared on social media would vary depending on the sharing channel (7, 11). False health information is disseminated similar to the right information, and they even draw more attention due to their attractive nature and utilizing emotions as well as exaggerations (7, 8). Despite all the negative effects related to sharing incorrect information, social media can have positive impacts. Therefore, they may act as a tool to raise people's awareness of different health issues, such as vaccine effectiveness and their consequent positive outcomes for individuals in society (7, 9). According to different surveys, people's uncertainty regarding vaccination is growing with the spread of misinformation in digital media as a mass media. Thus, between 20% and 50% of the US population has been estimated to refuse vaccination despite the availability of the COVID-19 vaccine. This issue can make it difficult for political and health authorities to realize the ultimate aim of public vaccination (8). According to the surveys, the incorrect information shared on social media such as Twitter seems to contradict the policies adopted by policymakers to confront the prevalence of a pandemic such as COVID-19 (12). The release of misinformation and incorrect information regarding COVID-19 has the potential to cause destructive effects as follows:

1. Significant threat to adherence to the vaccination schedule, especially since the threat can put those at risk who are most affected by the disease.
2. Incoordination in public health measures dealing with the COVID-19 crisis
3. Replacement of announcements published by official health sources with false information published on social media (11)

The most considerable threats of social media may include the dissemination of rumors and unreliable information and the absence of oversight on these networks, which directly influences the decision-making process and measures made by individuals and their behaviors in general (13).

The data and posts that are publicly available on social networks can be used to examine thoughts, emotions, and attitudes in dealing with the COVID-19 crisis (6). The individual's emotions are seen as a core [factor](#) in sharing information on the social media platform. This attitude is not limited to sharing, but individuals may, despite the availability of accurate information on social media, publish their views and opinions according to economic, social, etc., conditions in that field (8).

Given that people's emotions and attitudes can have a significant impact on the acceptance or rejection of vaccination, identifying people's emotions and attitudes towards COVID-19 vaccination is of special importance. One way to understand people's emotions towards various topics is through analyzing social networks.

Sentiment analysis is performed with the aim of finding people's opinions and attitudes towards different aspects of products and events on social networks (14).

Sentiment analysis has been extensively studied in previous research, analyzing emotions from various social networking data comprehensively. These studies have examined important events (15), the effects of medication (16), consumer sentiments towards a specific brand (17), and other topics (18).

Furthermore, the study seeks to delve into the emotions expressed by social media users regarding the COVID-19 vaccine. Emotions can significantly influence individuals' attitudes and behaviors towards vaccination, making it crucial to understand the range of emotions expressed and their underlying causes. Exploring these topics and emotions will enable us to identify dominant narratives, prevalent misinformation, or popular concerns that shape public opinion and decision-making processes related to the COVID-19 vaccine. Such findings can pave the way for more targeted and effective communication strategies to address vaccine hesitancy, alleviate concerns, and promote informed decision-making. Therefore, the aim of this article is to

conduct a systematic review of the topics discussed and the emotions expressed by users on social media platforms regarding the COVID-19 vaccine and gain a comprehensive understanding of the public discourse surrounding the vaccine on social media and explore the emotional responses of users. Therefore, the present study aims to answer the question of what are the topics and sentiments of users in social media posts related to the COVID-19 vaccine?

Material and Methods

This systematic review was designed based on the PRISMA guidelines (19) to review and analyze the opinions of social media users regarding the COVID-19 vaccine and vaccination. In this regard, PubMed, Scopus, and Web of Science databases have been searched to retrieve the relevant articles. The keywords used in the search strategy were extracted from the MESH database and also from previous studies and authors' experiences. The strategy presented in Table 1 was used to search for sources on November 20, 2021. Based on this, all the articles related to the study topic that were indexed in PubMed, Scopus, and Web of Science databases until November 21, 2021, were retrieved.

Inclusion criteria

The original articles published in English consistent with the study objective, with the articles' topics dedicated to reviewing users' opinions regarding the COVID-19 vaccination were considered the research inclusion criteria.

Exclusion criteria

The articles published in non-English languages were excluded from the study. Other articles, including review articles, short articles, letters to the editor, and case reports, were excluded as well. Moreover, the authors eliminated the papers whose full texts were unavailable and also the articles that focused on users' comments regarding side effects or about a particular vaccine.

Data selection and extraction

Following the selection of the relevant studies based on inclusion and exclusion criteria, the data was collected using a data mining form according to the study objectives. The titles, abstracts, and full texts of the articles were reviewed independently by two researchers. The possible discrepancies were referred to another person. The data extraction form included the following parts: authors' name and year of the study, social media title, number of the analyzed tweets or posts, geographical area, and the results.

Quality Evaluation

After selecting the relevant studies based on inclusion and exclusion criteria, data collected using a form that aligned with the study objectives. Researchers

independently reviewed the titles, abstracts, and full texts of the articles using the STROBE checklist (20). Only articles that met at least 20 out of the 22 checklist items were included in the study. The necessary data were then extracted from the eligible articles and recorded in Excel software. In cases where there were discrepancies, another individual was consulted for a second opinion.

Analysis Data

After collecting the data using the data extraction form, the collected data were analyzed using the content analysis method. This method allowed us to identify recurring patterns, themes, and codes within the data, enabling a comprehensive analysis of the content. For qualitative content analysis, the extracted data was gathered in an Excel file and the results were manually examined, analyzed, and reported.

Results

A total of 1725 papers have been identified and retrieved in the initial search of three databases, then entered into the reference management software End-Note. After removing duplicates and irrelevant items according to evaluating the titles, abstracts, and full texts, the authors ultimately selected 29 articles in line with the study objectives. Figure 1 outlines the process of searching and selecting the articles.

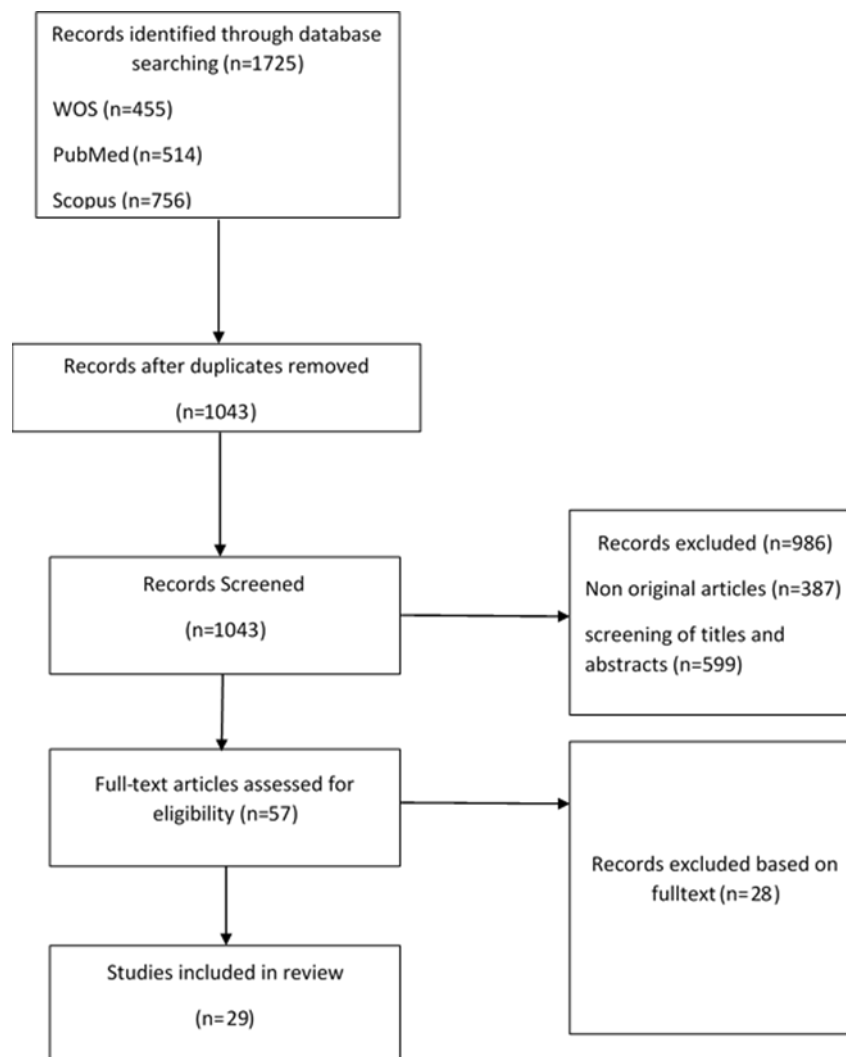


Figure 1. Article selection process chart

The features and results of the articles included in the study are summarized in Table 2. According to the data in Table 2, the social media studied in these articles were as follows: Twitter (25 articles), Weibo (2 articles), and Parler-Douban-Reddit (one article for each). The geographical areas of investigated posts were the United States (9 articles), India (4 articles), China (3 articles), Canada (2 articles), and the countries such as Saudi Arabia, Poland, Norway, Pakistan, Sweden, Philippines, South Korea, Australia, the United Kingdom, and Brazil (one article for each). Moreover, no geographical area had been considered for the ten articles for data extraction. The number of

posts or comments examined has also differed in different studies. In addition, the time intervals for gathering social media posts for analysis have been varied in various investigations.

Table 2. Results obtained from analyzing the selected studies

Authors and Year of Study	Social Media	Analyzed Posts or Comments	Geographic Area	Results
Alliheibi et al., 2021 (4)	Twitter	A total of n=37,467 tweets were collected during the period of December 15, 2020.	Saudi Arabia	<p>The comments distribution was as follows: Positive (approximately 54%), negative (34%), and neutral (12%).</p> <p>The positive comments included the keywords effective, safe, normal, protection, and caution, pointing to the common concept of reducing the risks associated with COVID-19 through vaccination, especially for the elderly.</p> <p>The negative comments, in turn, involved some words such as rejection, no, infertility, Gates, conspiracy groups, and DNA. These keywords focused on vaccines' ineffectiveness and failure to accurately evaluate the vaccines in clinical trials. They have also mentioned the relationship between the COVID-19 vaccines with infertility and DNA changes in people and a cover for a plan devised and developed by Bill Gates to traceable implant microchips to control people.</p>
Baines et al., 2021 (9)	Parler	Two samples were investigated, including a random sample (n=400) and a larger sample (n=7000) from November 20, 2020, to January 6, 2021.	United States	<p>This research has revealed five main topics among the data shared on this social media: a) reasons for rejecting the COVID-19 vaccine (40%); b) side effects of the COVID-19 vaccine (28%); c) population control through the COVID-19 vaccine (23%); d) the children vaccinated without their parental consent (5%); e) comparing the COVID-19 mortality rate with other diseases (2%).</p> <p>According to this research, accepting the COVID-19 vaccine mostly depends on two dimensions of awareness (39.4%) and access to the vaccine (27.3%). Based on this study, the most frequently discussed topic on Twitter has been related to awareness and access. People's negative views have prevailed regarding the awareness subject, while positive views have been more than negative views regarding accessibility. There have been other issues in individuals' perspectives; however, no specific classification is assigned to the two groups of awareness and acceptance. Some of them are as follows: the lack of information on the COVID-19 mutations, the need to research and gather data related to the complications of COVID-19 vaccines, and fake news and misinformation regarding the COVID-19 vaccine.</p>
Baj-Rogowska et al., 2021 (21)	Twitter	A total of n=105,849 Tweets were collected in May 2021 in Poland.	Poland	<p>According to this research, accepting the COVID-19 vaccine mostly depends on two dimensions of awareness (39.4%) and access to the vaccine (27.3%). Based on this study, the most frequently discussed topic on Twitter has been related to awareness and access. People's negative views have prevailed regarding the awareness subject, while positive views have been more than negative views regarding accessibility. There have been other issues in individuals' perspectives; however, no specific classification is assigned to the two groups of awareness and acceptance. Some of them are as follows: the lack of information on the COVID-19 mutations, the need to research and gather data related to the complications of COVID-19 vaccines, and fake news and misinformation regarding the COVID-19 vaccine.</p>

Batra et al., 2021 (1)	Twitter	Two examples in two different periods have been analyzed: n=23,000 tweets collected between January 1, 2020, and March 23, 2020, as well as n=226,668 tweets collected between December 2019 and May 2020. The analyzed tweets have been in the formats of text and images in English.	United States Canada India Norway Pakistan Sweden	Revealed by this research results, the number of tweets shared on Twitter has changed over time. For instance, the growing trend of tweets about the positive and negative emotions concerning vaccination has hit its peak on January 20 with the prevalence of a new mutation of the coronavirus. The changes in people's attitudes and views have occurred more in Asian countries (India and Pakistan) than in other countries. The mean rate of negative views was higher in India than the positive views. Moreover, neighboring countries in each continent show similarities and correlations regarding expressing emotions.
Bi D et al., 2021 (8)	Douban	A total of n=5665 users' comments on Douban were collected from December 2020 to April 2021 with no language limits.	China	The people's views have been varied regarding the COVID-19 vaccination at different times. At first, the number of negative comments about vaccination has shown a rise to a maximum of 44% at some point in time. The users' opinions have changed from neutral to negative at other time intervals. Regarding the analysis of the issues raised on social media, the number of topics with negative and neutral views was the highest and the lowest, respectively.
Bonnevie et al., 2021 (2)	Twitter	This retrospective longitudinal study examined and discussed the information about vaccines against COVID-19 and other diseases over two periods. The first period was from October 15, 2019, to February 14, 2020, and the second was from February 15, 2020, to June 14, 2020. A total of n=799,535 tweets and n=2,514,381 tweets were collected during the first and second periods, respectively.	Without considering any geographical area	The common topics raised in the two periods against vaccines were as follows: Negative effects on health (first period: 22%, second period: 16.9%) Pharmaceutical industry (first period: 11.2%, second period: 10.5%) Requirements and policies (first period: 10.6%, second period: 8.4%) Vaccine ingredients (first period: 10.4%, second period: 9.8%) Federal health authorities (first period: 8.3%, second period: 12%) Clinical research and trials (first period: 7.4%, second period: 7.7%) Religion (first period: 5%, second period: 1.7%) Vaccine safety (first period: 4.5%, second period: 2.7%) Prevalence of the disease (first period: 4.3%, second period: 1.9%) Schools (first period: 3.4%, second period: 1.6%) Family (first period: 3.3%, second period: 1.4%)

Boucher et al., 2021 (22)	Twitter	A total of n=636,516 tweets were collected between November 16, 2020, and November 26, 2020.	Without considering any geographical area	<p>By analyzing the tweets related to distrust of vaccines, the results have demonstrated that people's negative views on Twitter may manifest differently. Thus, people do not consider vaccination an appropriate option to prevent the COVID-19 pandemic since the mass production of vaccines takes much time. Moreover, the political bias of individuals and following the views of political figures can cause a negative view against vaccination. In addition, some proof of the ineffectiveness of vaccines in a series of tests may be a reason for creating negative views in people.</p> <p>Highlighting the side effects of vaccination and creating a haze of ambiguity can affect people and lead them to reject the vaccines. Lack of trust in vaccine-producing pharmaceutical companies has also been identified as a reason for opposing vaccination.</p>
Zhang et al., 2021 (23)	Twitter	A total of n=501,531 tweets were collected from January 1, 2020, to April 30, 2021.	Without considering any geographical area	<p>Twelve topics were extracted by analyzing the tweets according to the results obtained in this study: "vaccine availability," "vaccine effectiveness and unveiling," "vaccine development and public opinion," "vaccination status," "emotions and side effects," "vaccination time," "vaccines availability," "vaccination eligibility," "age and related issues," "preventive measures," "university students," "trust and communication."</p> <p>The results demonstrated that the most attractive tweets for the audience are posted regarding vaccine accessibility, vaccine effectiveness, and vaccine unveiling.</p>
Yousefina-ghani et al., 2021 (24)	Twitter	A total of n=4,552,652 available tweets were collected from January 7, 2020, to January 3, 2021. These tweets were related to the Pfizer, Moderna, AstraZeneca, and Johnson vaccines.	Without considering any geographical area	<p>According to the results, the neutral, positive, and negative categories accounted for 41%, 34%, and 25%, in respective order. Negative emotions covered a broad spectrum of concerns; however, most were concentrated on the time-consuming vaccine production process, doubts about vaccine safety, or the response to governments, political figures, and manufacturers. On the other hand, positive tweets usually focus on scientific advances, medical recommendations, and hope expansion.</p> <p>At the beginning of the year, pro-vaccine tweets prevailed in the media. However, when COVID-19 was declared an epidemic in mid-March, the anti-vaccine posts started to rise and kept their level until the end of May. As July went on, vaccine doubt-containing content increased slightly and remained stable until early November.</p> <p>The most significant authors in pro-vaccine groups were well-known individuals and agencies, including public health institutions, physicians, TV channels, newspapers, international organizations, and health professors.</p>

				<p>For anti-vaccine tweets, many top users had already been suspended by Twitter. However, several Twitter bots were found that were retweeting some tweets automatically. Other users who posted anti-vaccine tweets included political activists, writers, and artists. In this study, political activists were defined as Twitter users; the main topics of their posts were related to politics.</p>
Wang et al., 2021 (25)	Twitter	A total of n=154,978 tweets related to the Coronavirus hashtag were collected from March 20, 2020, to August 9, 2020.	United States	<p>The results of this study have revealed the core topics in tweets on masks and vaccination. The major topics about using masks are as follows: (1) Mask as a new norm (10.8%), (2) Face shield (10.3%), (3) Masks for a living (18.8%), (4) Advertising/Sales (46.8%), and (5) Government criticism (13.3%).</p> <p>Topics for vaccination included (1) Science (25.8%), (2) Vaccine-free control (25.0%), (3) Boosting immunity (14.9%), (4) Vaccine competition (14.3%), and (5) Politics (20.0%).</p> <p>According to the results, Twitter users have reacted more to the positive content about wearing masks ($t=2.32$, $p=0.02$). Moreover, negative content about vaccination has been more popular ($t=-3.17$, $p=0.0017$).</p> <p>Moreover, the level of popularity and feeling toward each subject have been varied over time.</p> <p>Out of the examined tweets, 83.38% were related to positive attitudes. In most of them, users mentioned their vaccination choice to encourage others. Phrases such as "Trust the science," "Vaccination works," and "A dose of hope" have been seen several times.</p>
Villavicencio et al., 2021 (26)	Twitter	A total of n=993 tweets were collected from March 1, 2021, to March 31, 2021	Philippines	<p>A small number of tweets with a negative perspective were analyzed as well. Some tweets have mentioned adverse side effects. However, some tweets have supported vaccinations despite possible side effects since the benefits of vaccination excel the risk of contracting the virus.</p> <p>Thus, only 8.26% of tweets had a negative concentration. Similarly, 8.36% of tweets were neutral.</p> <p>The process of expressing emotions was also variable in the published tweets over time.</p>

Thelwall et al., 2021 (27)	Twitter	A total of n=446 English tweets regarding the hesitation in getting the COVID-19 vaccine were collected from March 10, 2020, to December 5, 2020	Without considering any geographical area	This research has shown the issue of doubt in half (50.2%) of the tweets. The related topics have been conspiracies (23.5%), development rate (16.1%), and safety (10.5%). Political factions have expressed mainly their doubts regarding the COVID-19 vaccine on Twitter (79%) through a combination of conspiracy theories and plausible concerns about development rate and safety.
Sv et al., 2021 (28)	Twitter	A total of n=189,888 tweets were collected in March and April 2021.	India	According to the results, 33.6% of tweets with negative emotions were about the vaccines' side effects. Moreover, approximately 78.5% of tweets included neutral or positive emotions. According to the findings, positive emotions about the side effects of the COVID-19 vaccine have increased significantly since the second week of April. Besides, the most important concerns of users have been as follows: the fear of the possible effect of COVID-19 vaccination on the performance at work, possible death as a side effect of the COVID-19 vaccine, feeling of risks in getting vaccines, the Covishield bans in countries such as Norway, fear of long-term effects of the COVID-19 vaccine, fear of the occurrence of blood clots, the fear caused by the media, safety measures at the vaccination site, and vaccine efficiency
Shim et al., 2021 (29)	Twitter	A total of n=3509 tweets were collected from February 23, 2021, to March 22, 2021.	South Korea	The results suggested that hesitation in getting vaccines with a relative weight of 14.2% has been the most common tweeted topic. The second and third most frequent topics have been "vaccine development" (13.1%) and "quarantine prevention policy" (13.0%). The other topics were as follows: "Vaccination effectiveness" (12.6%), "Prioritized vaccination of hospital staff" (12.0%), "Media about COVID-19 vaccines" (11.9%), "Medical Association Reaction" (11.8%), and "Side effects" (11.4%). The ratios of positive and negative tweets were similar immediately before and after starting the vaccination; however, the negative tweets were highlighted following the increased number of confirmed COVID-19 infections. People's expectations, frustrations, and fears about the vaccine were reflected in the tweets.

Sattar et al., 2021 (30)	Twitter	A total of n=1,200,000 tweets were collected from April 10, 2021, to May 17, 2021.	United States	<p>.The general emotions expressed in the tweets have been more positive rather than negative despite some side effects found in using some vaccines.</p> <p>Although the majority of tweets (60 to 70%) were considered neutral, the rest portion mainly included positive tweets (20 to 25%).</p>
Praveen et al., 2021 (31)	Twitter	A total of n=18,440 tweets were collected in September, October, November, and December 2020.	India	<p>Almost 47% of the posts in the last four months of 2020 have been focused on vaccines and their effects in a neutral tone, while 35% and 16.6% of the posts about vaccines with a positive tone and a negative tone, respectively. Slight changes have occurred in positive and neutral emotions, and a considerable drop in negative emotions as changes have been made in the number of cases. Positive emotions increased by approximately 1.4% in December compared to the prior four months, and negative emotions decreased by 5.2% in December compared to October.</p> <p>According to the results, tweets have been published on the following topics:</p> <ul style="list-style-type: none"> Fear of health Allergic reactions Fear of death Hesitations about vaccines Exaggeration in the COVID-19 Negative emotions towards pharmaceutical companies Doubts about data Different vaccines Hasting in producing vaccines <p>Fear of health and allergic reactions to the vaccine were also two major issues among Indian citizens' concerns about the COVID-19 vaccines.</p>
Monselise et al., 2021 (32)	Twitter	A total of n=7,948,886 tweets were collected from December 18, 2020, to February 12, 2021.	Without considering any geographical area	<p>The three important topics in this study were identified as follows: "Vaccination of healthcare workers," "Access to vaccines - online registration," and "The South African type." Other topics were mainly related to concerns about vaccines and their supply and distribution.</p> <p>Some topics concerning the profits of pharmaceutical companies and conspiracy theories have also been discussed.</p> <p>The analysis revealed that events reported in the news had affected the peak of the topics, which have been broadcasted through social media.</p> <p>Emotion analysis indicated that 46.9% of tweets were negative, associated with fear emotions, followed by 33.2% of tweets entangled with grief and anger.</p> <p>Positive tweets were associated with emotions of joy and hope. Moreover, 19.9% of tweets were found to be neutral</p>

Mir et al., 2021 (33)	Twitter	A total of n=23,575 tweets were collected from January 12, 2021, to February 13, 2021.	Without considering any geographical area	<p>A gradual drop in tweets has been seen over time. A large portion (47.52%) of tweets were found to express positive emotions with neutral emotions (33.71%) and negative emotions (18.75%) in the following ranks. Moreover, this research revealed a considerable difference between the impacts of tweets sent by approved and unapproved users. The approved users' tweets further affect retweeting (65.91%) and getting likes (84.62%) than the unapproved tweets. Tweets expressing positive emotions show the highest impact in terms of likes (mean=10.48) and retweeting (mean=3.07) compared to the tweets expressing neutral or negative emotions.</p>
Melton et al., 2021 (34)	Reddit	A total of 13 forums were investigated from December 1, 2020, to May 15, 2021.	United States	<p>Five topics for the posts were detected in this study, including vaccine, safety concerns, efficiency, and side effects. The focused analysis of the combined (composite) datasets brought the following results: positive posts (56.68%), negative posts (27.69%), and neutral posts (15.63%). The findings suggested the occurrence of changes in people's emotions over time</p>
Lyu et al., 2021 (35)	Twitter	A total of n=1,499,421 unique tweets were collected from n=583,499 different users from March 11, 2021, to February 31, 2021.	Without considering any geographical area	<p>The results were as follows: the themes of opinions and emotions about vaccines and vaccinations (27.04%), knowledge about vaccines and vaccinations (23.7%), vaccine as a global issue (20.76%), vaccine administration (17.79%), and advances in vaccine development and licensing (10.72%). The vaccine development worldwide became a topic of debate around August 11, 2020, when Russia approved the first COVID-19 vaccine. As vaccine administration progressed, the issue of training on receiving vaccines gradually got more highlighted and turned into the most controversial topic after the first week of January 2021. The mean weekly emotion scores showed that the emotions were increasingly positive despite some fluctuations. Emotion analysis also revealed trust as the most prevailing emotion, followed by expectation, fear, sadness, etc. When Pfizer announced on November 9, 2020, that its vaccine was 90% effective, the feeling of trust reached its peak</p>

Luo et al., 2021 (36)	Twitter and Weibo	Twitter and Weibo were investigated from December 1, 2020, to February 20, 2021.	United States & China	<p>According to emotions analysis, neutral tweets (49.99%) had the highest rate, followed by positive tweets (30.62%) and negative tweets (19.40%). The majority of Weibo posts were positive (40.64%) in comparison with Twitter, followed by neutral posts (37.44%) and negative posts (21.92%). The discussed topics on Twitter were as follows:</p> <ul style="list-style-type: none"> Promoting vaccines and anti-vaccine discourses Personal vaccination experience Vaccination of priority groups Government vaccination policies Challenges of different types of the COVID-19 Vaccination advances around the world <p>The discussed topics on Weibo were as follows:</p> <ul style="list-style-type: none"> Policies and priority groups Research and development of domestic vaccines Challenges of different types of the COVID-19 Global epidemic progression WHO support and evaluation Epidemic development in the United States
Liu et al., 2021 (37)	Twitter	A total of n=2,678,372 English tweets regarding the COVID-19 vaccine were collected from November 1, 2020, to January 31, 2021, and analyzed.	Without considering any geographical area	<p>with negative emotions (30.3%). Five topics for positive emotion tweets (test results, management, life, information, and efficiency) and five topics for negative emotion tweets (test results, conspiracy, trust, effectiveness, and management) were identified in this study.</p>

Liew et al., 2021 (38)	Twitter	. A total of n=672,133 tweets were collected from November 2020 to February 3, 2021.	Without considering any geographical area	<p>Six general topics were recognized for the analyzed tweets as follows:</p> <ol style="list-style-type: none"> 1. Emotional reactions to COVID-19 vaccines (19.3%) 2. General concerns about COVID-19 vaccines (19.6%) 3. Discussion of vaccines-related news (13.3%) 4. Public health communications about vaccines (10.3%) 5. Discussion on vaccination approaches (17.1%) 6. Discussion on vaccine distribution (20.3%) <p>The tweets contacting negative emotions were mostly included the themes of emotional reactions and general concerns related to COVID-19 vaccines. The tweets about vaccination facilitators have revealed time changes over time, while obstacle-related tweets remained largely constant throughout the study period.</p>
Kwok et al., 2021 (39)	Twitter	A total of n=31,100 English tweets were collected from January 22, 2020, to October 20, 2020.	Australia	<p>The results have revealed three topics as follows:</p> <ol style="list-style-type: none"> 1. Attitudes toward COVID-19 and its vaccination 2. Supporting infection control measures against COVID-19 3. Misconceptions and complaints about the COVID-19 control <p>Almost two-thirds of emotions of all tweets have expressed a positive public opinion about the COVID-19 vaccine, while about a third were negative. Trust and expectation have been two highlighted positive emotions in the tweets out of all emotions expressed, while fear was the highest negative emotion. In addition, the level of emotions in tweets varies over time.</p>
Karami et al., 2021 (40)	Twitter	A total of n=200,000 tweets were collected from November 1, 2020, to February 28, 2021.	United States	<p>The results showed that 33.64% and 66.36% of the tweets were negative and non-negative, respectively. The rate of negative tweets has followed a decreasing trend, while the rate of non-negative tweets has been upward.</p> <p>According to the final analysis, five major topics of negative tweets included vaccination sites, vaccine receiving stories, vaccine effectiveness, information, and management. Moreover, the government, hesitating in getting vaccines, vaccine immunity, vaccines, masks and social distancing, and comparisons of vaccination strategies of governments were identified as the main five topics in non-negative tweets.</p> <p>This study also revealed the change in emotions contained in tweets over time.</p>

Jiang et al., 2021 (41)	Twitter	A total of n=100,209 tweets were collected from February 20, 2020, to March 31, 2020.	United States	<p>The results of this study have described 26.3% of tweets as news related to the coronavirus and vaccine development, 25.4% as public discussion and searching information on COVID-19, 12.9% as financial concerns, 12.7% as the discharge of negative emotions, and 9.9% as prayers and positive requests. In addition, 8.1% and 4.9% of tweets have focused on vaccine effectiveness, treatment, and conspiracy about the coronavirus and its vaccines.</p> <p>Various topics have changed over time, most closely connected with news or events related to vaccine development. Twitter users busy discussing conspiracy theories, vaccines' effectiveness, treatments, and financial concerns had more followers than people discussing other vaccine topics. The level of interaction - the rate of retweets, quotes, likes, or replies to tweets by other users - was similar among the different themes; however, tweets discharging negative emotions had the lowest interaction rate.</p>
Hou et al., 2021 (42)	Twitter and Weibo	A total of n=7032 posts were collected from June 13, 2020, to July 31, 2020.	New York (USA), London (UK), Mumbai (India), Sao Paulo (Brazil), and Weibo posts from Beijing (China)	<p>With the increased risk of COVID-19, more tweets in New York and London were posted as distrusting the vaccine safety, distrust of governments and experts, misinformation, or widespread rumors.</p> <p>Tweeters from Mumbai, Sao Paulo, and Beijing were more concerned about vaccine production and supply, while New York and London tweeters had more concerns about vaccine distribution and inequality. Negative tweets indicating distrust of the vaccine and false information or rumors had more advocates and had attracted more public participation in cyberspace.</p>
Griffith et al., 2021 (43)	Twitter	A total of n=605 tweets about the hesitation in getting the COVID-19 vaccine were collected from December 18, 2020, to December 23, 2020	Canada	<p>The tweets with doubts about the vaccine have originated from the following themes: safety concerns, suspicions about political or economic forces involved in the emergence of the COVID-19 pandemic or vaccine production, lack of knowledge about vaccines, anti-vaccines or confusing messages from authorities, and lack of legal liability on the part of vaccine-producing companies.</p> <p>These themes are classified into five theoretical structures: knowledge, beliefs about consequences, context and environmental resources, social impact, and emotions.</p>

The analyzed articles, given in Table 1, have classified users' emotions and emotions about the COVID-19 vaccine into three positive, negative, and neutral emotions groups. Some other papers have also identified the topics of users' posts and comments on social media regarding the COVID-19 vaccine through analysis.

According to many studies, a large portion of the emotions expressed by users regarding the COVID-19 vaccine on social media has been positive or neutral (4,24, 26, 28, 30, 31, 33, 34, 36, 37, 39, 40). Some studies have also demonstrated a higher frequency of negative emotions over positive emotions in users' posts and comments about the COVID-19 vaccine (1, 8, 29, 32). The occurrence of some changes in the emotions expressed by users in posts and comments about the COVID-19 vaccine on social media have been monitored over time as well (1, 8, 24, 25, 26, 29, 31, 34, 35, 39, 40).

The most frequent topics appearing in posts and com-

ments shared by social media users were as follows: Safety and efficiency (2, 4, 23, 24, 25, 27, 29, 37, 40, 41, 43), vaccine development and its development rate (23, 27, 29, 31, 35, 36, 41), prevention policies and health and political authorities (2, 24, 25, 29, 40, 43). Other topics included vaccine side effects (4, 2, 21, 23), reasons for acceptance or rejection (4, 21, 31), priority groups for receiving vaccines (29, 32, 36), and vaccine-producing companies (2,25,31). Other topics have also involved the discussion of general vaccine information and vaccination.

The conceptual diagram of analyzing the users' emotions about the COVID-19 vaccine on social media according to the present results is illustrated in Figure 2. Conceptual figure 2 has been drawn based on the findings of the studies examined in table 2. Figure 2 illustrates the positive and negative emotions related to COVID-19 vaccination, as well as the topics associated with positive and negative emotions about COVID-19 vaccination.

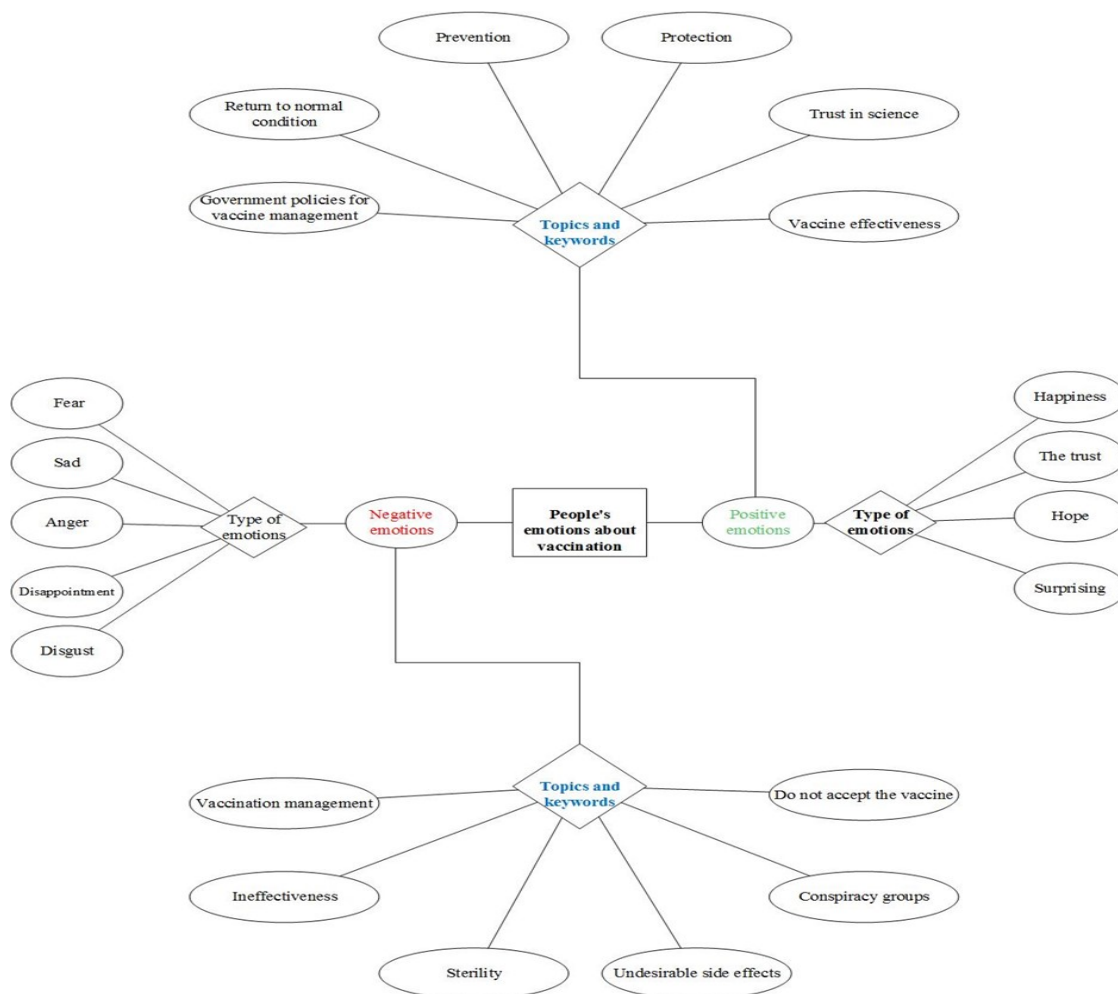


Figure 2. Illustration of emotions expressed by social media users about the COVID-19 vaccine

Discussion

This systematic review was designed to examine and analyze the topic and emotions expressed in comments and posts shared by users on social media regarding the COVID-19 vaccine. According to the findings, most of the emotions and emotions represented by users regarding the COVID-19 vaccine in posts published on social media appeared to be positive or neutral. However, there were negative emotions expressed in these posts at different time intervals.

Positive emotions of people on social media regarding vaccines happen as a reaction to news and information related to the safety and effectiveness of vaccines. In this context, Alliheibi et al. suggested that positive responses and emotions involved the keywords effective, safe, normal, protection, and caution, representing a decrease in the risks related to COVID-19 due to the vaccine efficiency. Moreover, negative reactions and emotions contained words such as rejection, no, infertility, conspiracy groups, and DNA, reflecting the ineffectiveness of vaccines and the failure of accurate evaluation of vaccines in clinical trials (4). Representing negative emotions by individuals happens due to their fears and concerns (44, 45). According to literature, people's activity has grown increasingly on social media in response to the COVID-19 crisis, which would lead to emotional use of social media considering the current situation. The emotional use of social media such as Twitter to share information may cause a considerable challenge for people's health and ongoing efforts to fight the spread of this disease since it may make this information incorrect and part of conspiracy theories (6). Such theories affect people's way of thinking about vaccination and raise doubts about vaccination (9) because people rely on social media to receive up-to-date information in times of crisis (46). In addition, inaccurate information and conspiratorial content can create stronger anti-vaccine beliefs and provoke emotions and changes in people's health behaviors since users fail to pay attention to the validity of the contents.

The findings also revealed that the individuals' emotions about the COVID-19 vaccine have varied during the COVID-19 pandemic and have changed at different time intervals. Since vaccination started at different times in various countries, different reports have been published regarding its side effects and effectiveness worldwide. Accordingly, the number of tweets shared on Twitter has experienced many changes over time. For instance, the increasing trend of tweets with positive and negative emotions about vaccination hit its peak on January 20 with the emergence and spread of a new type (mutation) of the coronavirus. Therefore, it can be said that people's emotional aspects are affected by events related to health issues and can change the direction towards a

positive or negative attitude (1). Moreover, the views and emotions of people during the pandemic may come from different factors. For example, they can be originated from media advertising and are related to vaccination policies (8). A long time of mass production, highlighting the side effects of vaccination, and the occurrence of different ambiguities can also influence people's views and emotions regarding the acceptance and rejection of the vaccine (22). The rate of releasing misinformation has been minimized by applying the policies to prevent the dissemination of false information on social media during the COVID-19 pandemic (11), which influences users to express their emotions on social media.

It was also demonstrated that the major topics discussed by users on social media about the vaccine are safety and effectiveness, vaccine development and development rate, prevention policies, and health and political authorities.

Since the safety and effectiveness of the vaccine seem to be core concerns of people influencing individuals' acceptance or rejection of the COVID-19 vaccine (47), it can be said that people on social media look for information related to the COVID-19 vaccine' efficiency and immunogenicity. In addition, due to the ongoing development and production of various vaccines by different companies and countries to fight COVID-19, which has been still in the initial testing and experimenting phase (48), users naturally show different reactions to this issue and follow up on news and information related to the vaccine progress and development.

Social media have been used by users worldwide in the COVID-19 pandemic as a tool to enhance awareness of people regarding various health issues such as vaccine effectiveness and its positive outcomes (9). This issue, in turn, can promote community health programs through familiarity with individuals' views on social media (21). According to previous studies, social media may contribute to further interaction and participation of people in vaccination to prevent mortality and relevant complications as a communication channel by sharing up-to-date and scientific information concerning the safety and effectiveness of vaccines to treat infectious diseases, especially the COVID-19 (10).

Health and political officials and organizations also shared different comments or laws and regulations on social media during the COVID-19 pandemic, which became one of the significant topics discussed among social media users. Individuals, organizations, and governments employ social media to communicate about several issues related to the COVID-19 pandemic (6). The language used by political elites regarding the healthcare area will affect people's opinions and health-related behaviors (49). Therefore,

political leaders can benefit from their influence on public opinion to address health-related issues (15). According to the evidence, political statements have the potential to create remarkable differences in public opinion regarding healthcare measures (50). Additionally, Karami et al. discovered that negative tweets frequently covered vaccination sites, personal accounts of vaccine experiences, vaccine efficacy data, as well as the management of vaccine distribution. On the other hand, non-negative tweets often discussed administrative aspects, vaccine hesitancy, vaccine immunity, the use of masks, social distancing measures, and comparisons of different vaccination strategies (40).

Some other topics that have been discussed on social media concerning vaccines are as follows: vaccine side effects, reasons for acceptance or rejection, priority groups for vaccination, vaccine-producing companies, and general information regarding the vaccines and vaccination.

Based on a survey conducted (51), individuals exhibiting vaccine hesitancy primarily express concerns regarding side effects, emergency approval, and effectiveness of the COVID-19 vaccine. In their analysis, Jun et al. observed that over 1% of COVID-19 vaccine-related tweets mentioned 'side-effects'. They also found a positive correlation between side-effect mentions, death, negative sentiment, and the emotions of fear, sadness, and anger at a preliminary level. These findings suggest that when a larger number of individuals within a country express concerns about vaccine side-effects or primarily focus on adverse vaccination events on social media, it can negatively impact trust and participation in vaccination efforts within that country (52).

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Conclusion

Social media have the potential to help understand attitudes and behaviors during a public health crisis and promote health messages. Attitudes toward vaccination are almost formed by information and ideas faced by individuals via social media. Therefore, effective management and use of social media may effectively contribute to improving disease management and crisis management.

According to the results obtained in this study, it can be said that getting aware of people's views on social media platforms matters to policymakers in designing communicative strategies for health communications. In addition, experts and public health organizations should resolve people's concerns and views on vaccine effectiveness to enhance public confidence in vaccines. Accordingly, health policymakers need to pay attention to all the general public's views regarding the COVID-19 vaccination since overlooking those views can cause serious problems in controlling epidemics in different countries and regions. Furthermore, Based on the findings of the present review study, the following suggestions are proposed for researchers and public health policymakers:

- Enhance public health communication
- Monitor social media sentiment
- Identify and address misinformation
- Foster vaccine confidence

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Systematic review

Night blindness and associated factors among pregnant women in Ethiopia: A systematic review and meta-analysis

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Abstract

Background: Night blindness is a significant public health problem among pregnant women in Ethiopia. This systematic review and meta-analysis aimed to estimate the pooled prevalence of night blindness and its associated factors among pregnant women in Ethiopia.

Methods: Studies were searched using electronic databases such as PubMed, Science Direct, and gray literature using Google scholar as well as manual search of reference list of previous studies to retrieve related articles. We used a total of Seven primary studies in our review. Quality of all eligible studies was checked using JBI critical appraisal assessment tool. Data extraction and analysis were performed using Microsoft excel-10 and STATA 17 software respectively. Heterogeneity and publication bias were checked using the I² statistic and Egger's test, respectively. Meta-analysis was carried out using random-effects model.

Results: The overall pooled prevalence of night blindness among pregnant women in Ethiopia was 19.32% (95% CI: 12.61-26.04). Subgroup analysis revealed that high prevalence of night blindness found in the Amhara region which was 21.41% (95% CI: 12.83-30.13), but lower prevalence found in the southern region which was 10% (95% CI: 4.23-15.77) and Meta-analysis using two primary studies revealed that those night blinding among age 35 and above have 3.02 (95% CI: 1.73-5.24) times higher risk of getting blind compared to those pregnant women age less than 25 years old.

Conclusion: The overall pooled prevalence of night blindness among pregnant women in Ethiopia was 19.32%. Pregnant women age greater than 35 years were significantly affected by night blindness. So, strengthening the multivitamin supplementation including vitamin A to reproductive age women is crucial and improving women's married during teenage is an important intervention to tackle maternal night blindness.

Keywords: Prevalence, Associated factors, Age, Night blindness, Ethiopia, Pregnant women

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Introduction

The inability to see normally after dark or at night while getting pregnant, particularly in the third trimester and postpartum is known as maternal night blindness. Night blindness is the most prevalent visual symptom of mild to moderate vitamin A deficiency. Rhodopsin, which is found in retinal receptors, allows us to see in low light (rods), as shown by the absence of late-dark adaptation or problems

(1,2). About 9.8 million Women worldwide are affected by night blindness, or 7.8% of the population at risk for Vitamin A Deficiency (VAD). In Southeast Asia (9.8%) and Africa (9.8%), more women (9.8%) are affected by night blindness. Each is thought to have an impact on over 3 million expectant mothers, or one-third of all affected women worldwide. Each year, it is estimated that more than 6 million pregnant women suffer from night blind-

ness. Public health priorities in 66 countries are moderate to severe night blindness prevalence. A cutoff point of 5% maternal night blindness prevalence is advised for the identification of VAD as a significant public health issue(3,4).

Women with night blindness are more likely to be both infectious (such as having urinary and genital infections, diarrhea, and dysentery) and non-contagious (such as preeclampsia and symptoms of anorexia, nausea, and vomiting (5, 6).

When there is VAD, pregnant women are among the most at risk for night blindness, and vitamin A is one of the micronutrients needed during pregnancy. Around the world, VAD is thought to affect 19 million pregnant women, and each year, more than 6 million of these women develop night blindness. Prevalence of night blindness in pregnant women is a moderate to serious public health concern in 66 countries. Over 3 million pregnant women in each region are affected by night blindness, which affects a comparable and significant percentage of pregnant women in South-East Asia (9.9%) and Africa (9.8%)(4,9). These are the problems Ethiopian expectant mothers are facing. On the other hand, the economy, the population, the weekly diet, the weekly history, and other risks have an impact on night vision (5,6). Night blindness, on the other hand, is affected by the economy and population, weekly nutrition, weekly history, and other risks(6,7).

An easy way to identify a vitamin A deficiency is to look at a family history of night vision during pregnancy. The dark-adapted threshold is a functional measure of vitamin A status and is closely related to serum retinol concentrations(8). The purpose of this systematic review and meta-analysis was to determine the pooled prevalence of night blindness and associated factors among Ethiopian pregnant women.

Methods

Identification and Study Selection

Google Scholar, PubMed/MEDLINE, and Science Direct were used as electronic databases. The search terms were (Prevalence OR Magnitude OR Epidemiology) AND (Night blindness) AND (Age greater than 35 years old) AND (among Ethiopian pregnant mothers). his systematic review and meta-analysis followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

Eligibility criteria

Title and Abstracts of the searched results were reviewed based on the following inclusion and exclusion criteria:

Inclusion Criteria.

Research articles conducted among Ethiopian pregnant women were included

Cross-sectional study design

Literatures published in the English language

Studies conducted among Ethiopian pregnant women

Published articles between 2011 and 2019

Exclusion Criteria

If there were more than one paper that was extracted from one specific study

More complete reported data were considered from only one paper

Duplicate citations and non-relevant articles

Data Extraction

Two authors (D.S and H.E) independently extracted all the necessary data using a standardized data extraction format prepared in Microsoft Excel 16. Each paper was reviewed and selected by two reviewers (D.S and H.E). In data extraction format the first author, Study period, publication year, region, sample size, response rate, and prevalence of night blindness were included.

Outcome measurements

Our systematic review and meta-analysis had two main objectives. The first objective was to determine the pooled prevalence of night blindness among pregnant women in Ethiopia. The second objective was to estimate the pooled factors of night blindness.

Quality of the studies included in this review

Two authors (D.S and H.E) independently evaluated the qualities of the original articles using JBI critical appraisal assessment tool as a guideline. All of the studies were assessed with JBI critical appraisal checklist for cross-sectional studies.

Statistical Procedure

Important data were extracted using a Microsoft Excel format. After extraction, the data were imported to STATA version 17.0(software) for analysis. The characteristics of original articles were described using texts, table, and forest plot. The standard error of prevalence for each original article was calculated using the binomial distribution formula. Heterogeneity among the reported prevalence of studies was checked using a heterogeneity χ^2 test and I^2 test. Publication bias was also examined by performing Egger's correlation and Begg's regression intercept tests at a 5% significant level.

Results

Literature search Results

In the first step of our search, 72 articles were retrieved systematically regarding the magnitude of night blindness among pregnant women in Ethiopia using electronic database such as Midline/PubMed, Google Scholar and Science Direct, and additional 15 records were identified through other sources. From the 72 articles, 41 articles were excluded due to duplication. Additionally, 23 articles were excluded after reviewing their titles, abstracts and full text in which we found

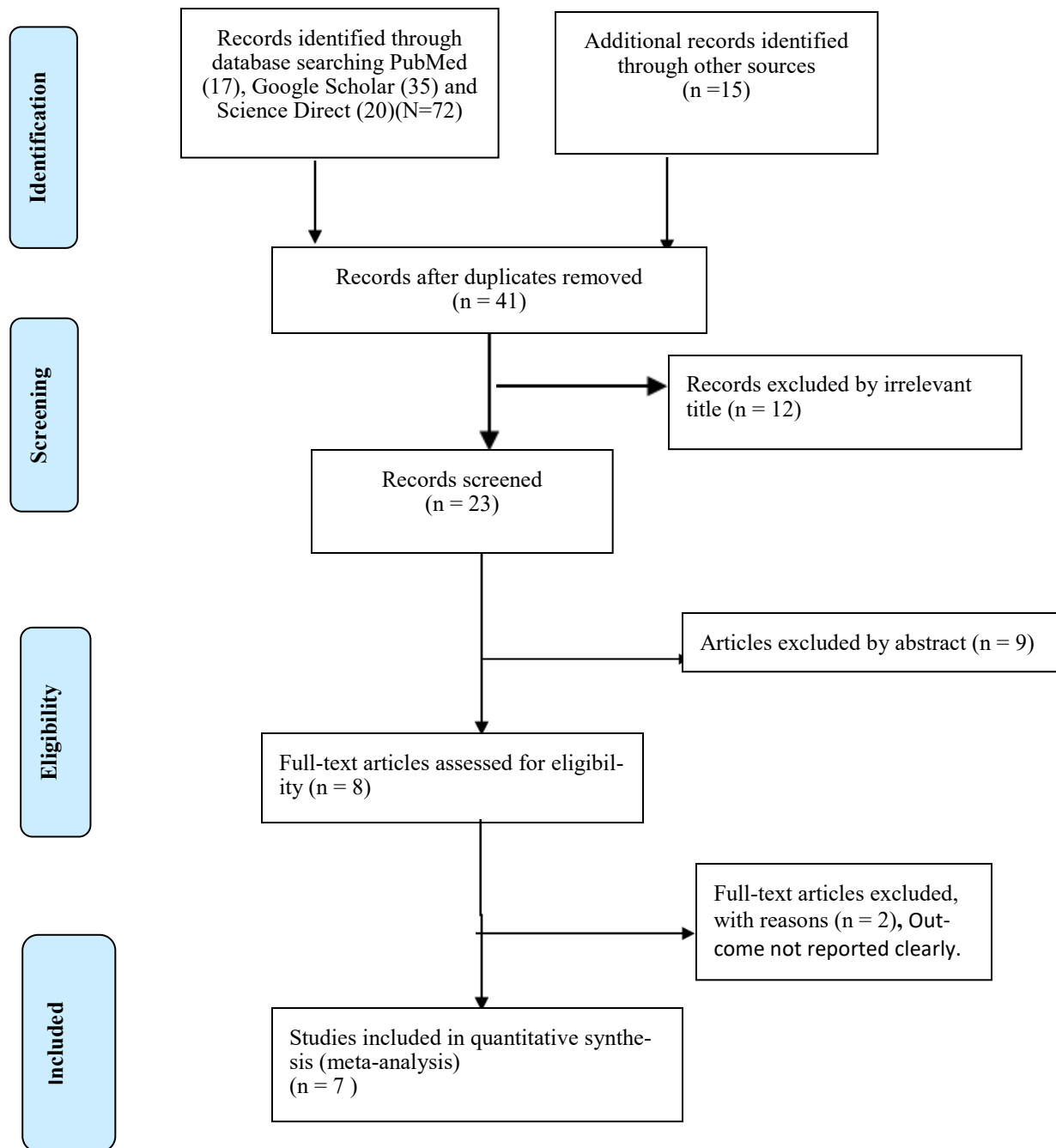


Figure 1: A PRISMA Flow chart explaining the selection of primary studies for systematic review and meta-analysis of magnitude of night blindness among pregnant mothers in Ethiopia (2022).

Original Article Characteristics

The summary of descriptive characteristics of Seven (7) primary studies included in this systematic review and meta-analysis is given in table 1. Searching and collecting of the studies in different region of the country were done from 2011 to 2020 in all regional states of Ethiopia. Seven articles were includ-

ed in the review with the sample sizes ranging from 104(10) to 742(3); whereas the lowest magnitude of night blindness was reported from SNNPR region [10% (95% CI: 4.23, 15.76)](10) and the highest in Amhara region [38.9%, (95% CI: 35.11- 42.76)](11) (Table 1).

Table 1: Summary of the magnitude of night blindness among pregnant mothers in Ethiopia included in the systematic review and meta-analysis (2022).

Region	First author	Publication year	Sample size	Response rate	Prevalence(95% CI)	Quality (JBI)
Tigray	Oumer Seid	2015	323	100	17.3(13.17-21.42)	Low risk
Amhara	Abebaw Baytekus	2019	742	98.4	13.7(11.20-16.19)	Low risk
SNNPR	Hiwot Abebe	2014	104	100	10(4.23-15.76)	Low risk
Amhara	Kibrom Legese	2012	480	97.9	18.6(15.08-22.11)	Low risk
Amhara	Melaku Tadege	2019	251	94.36	17.9(13.15-22.64)	Low risk
Amhara	Andargachew Mulu	2011	423	100	18.4(14.70-22.09)	Low risk
Amhara	Addisalem Damtie	2020	624	98.89	38.9(35.11- 42.76)	Low risk

Meta-Analysis

The forest plot shows the results of total primary studies included in our review. The pooled prevalence of night blindness among pregnant women in Ethiopia was 19.32% (95% CI: 12.61-26.04). Heterogeneity was seen across the studies detected by I^2 statistic ($I^2 = 95.5\%$, p value=0.000). Therefore, a random effects model was used to estimate the pooled prevalence of night blindness among pregnant women in Ethiopia.

With regard to publication bias, Begg's and Eggers's tests were checked, and no significant publication bias was observed as evidenced by $p = 0.764$ and $P = 0.780$, respectively (Figure 2).

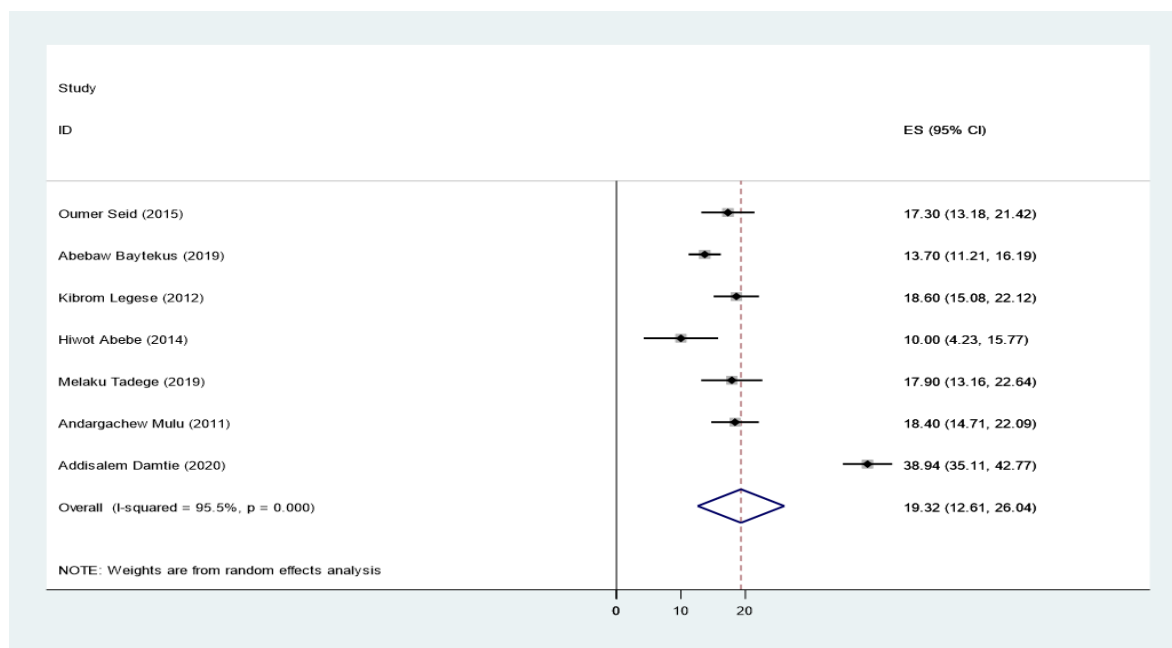


Figure 2: Forest plot for the pooled prevalence of night blindness among pregnant women in Ethiopia (2022).

Subgroup Analysis

We did a subgroup analysis based on the region for the meta-analysis. The studies were grouped based on the region. The highest (21.41%) prevalence of night

blindness was in Amhara region (95%CI: 12-83-30.13), and the lowest (10%) was in the southern region(95%CI:4.23-15.77)(Figure 3).

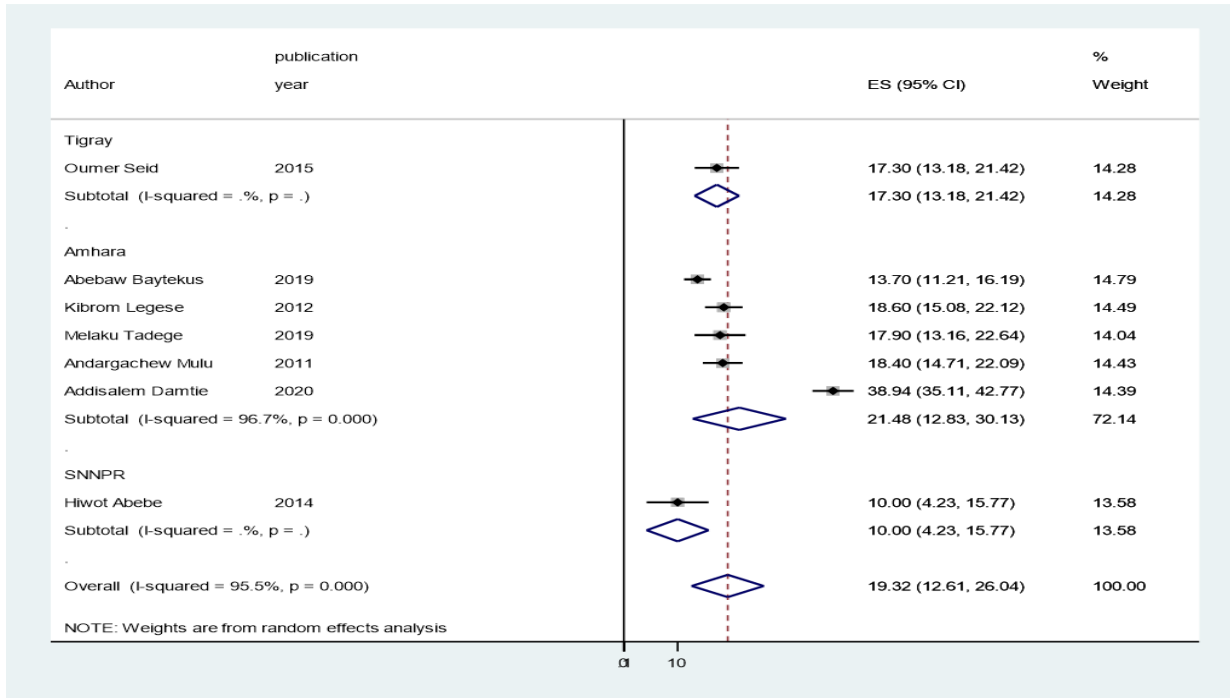


Figure 3: Forest plot for subgroup analysis by region of the studies of magnitude of night blindness among pregnant women in Ethiopia (2022).

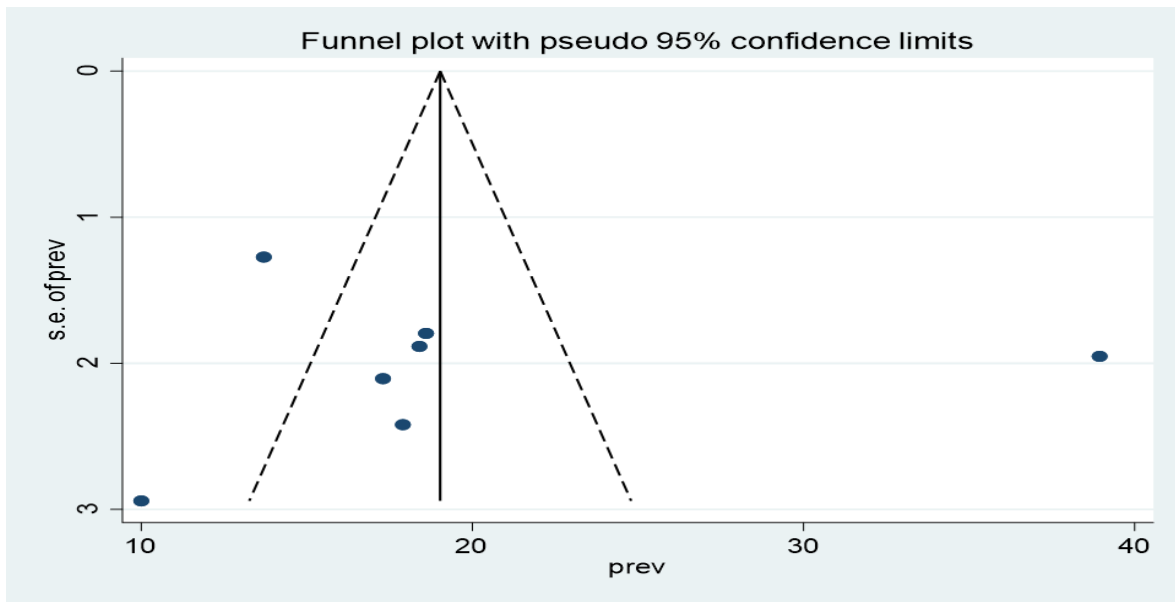


Figure 4: funnel plot for the pooled magnitude of night blindness among pregnant women in Ethiopia (2020).

Association of night blindness and pregnant women's age

In this study, we have examined the association between night blindness and age of pregnant women.

Meta-analysis using two primary studies revealed that night blindness was 3.02(95% CI:1.73-5.24) higher among age 35 and above than age less than 25 years old(Figure 4).

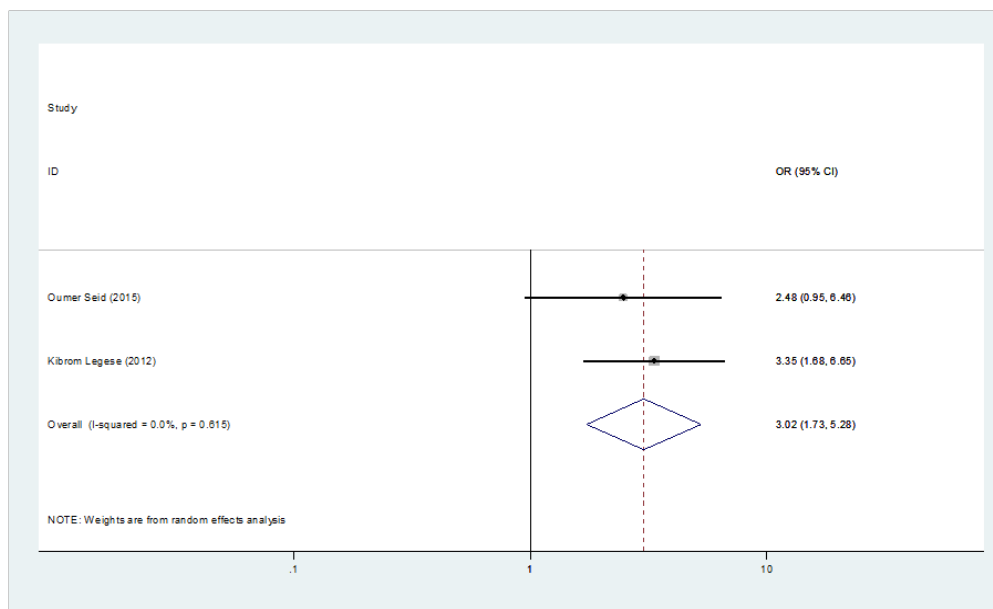


Figure 5: Forest plot showing the association of night blindness and age of pregnant women in Ethiopia (2022).

Discussion

Maternal night blindness is common during pregnancy in many developing countries. Globally, night blindness affects 9.8 million women which is 7.8% of the population at risk of VAD. A comparable and high proportion of women affected by night blindness are in Africa (9.8%) and South-East Asia (9.9%), estimated to have over 3 million pregnant women each affected, or one third of the women affected globally(4,9,12).

In the first step of our search, 72 articles were retrieved systematically regarding the prevalence of night blindness among pregnant mothers in Ethiopia using electronic database such as Midline/ PubMed, Google Scholar and Science Direct. From the 72 articles, 41 were excluded due to duplication. Additionally, 27 articles were excluded after reviewing their titles, abstracts and full text found non-relevant to our review. Only 8 articles were found to be eligible and included in analysis.

This systematic review and meta-analysis used seven studies to determine the pooled prevalence of night blindness among pregnant women in Ethiopia, which was 19.32% [12.61-26.04]. This prevalence is above three times the cut of point of public health importance of World Health Organization

definition of night blindness (night blindness cut of point $\geq 5\%$)(6).

The prevalence of night blindness was consistent with that of a study conducted in the Republic of Congo (16%) (13), Pakistan(16.2%)(14), Bangladesh (37%) (15) and Nepal (21%)(16). However, our result was higher than that of the study conducted in West Pacific (5%)(17). The possible explanation for the variations might be due to differences in study settings. This means, some studies were conducted in urban communities among well informed participants. Differences in study periods might also affect the Vitamin A status of pregnant women, and The study conducted in rural Terai Nepal showed lower prevalence of night blindness (7%) among pregnant & lactating women to the present study(18).

This might be due partly to implementation of treatment for vitamin A deficiency, and A study conducted in rural South India indicated that the prevalence of night blindness during pregnancy (5.2%) among women at delivery (19). This might be attributed to the large sample size used in the study.

The subgroup analysis of this study also showed that the prevalence of blindness varies across regions in

Ethiopia. The highest prevalence of night blindness was seen in people living in Amhara region which was 21.48% (95%CI: 12.83-30.13) but lower prevalence was found in the Southern region was 10 % (95%,CI:4.23-15.77).

In our study pregnant woman age greater than 35 years old were 4.5 times night blinded than below 25 years old of their counterpart, and the risk of developing night blindness increases with age. The result of this study is in agreement with that of a study conducted in Nepal which also reported that pregnant women age over 30 years had highest risk for night blindness than those who are below this age range (18). This may be due to depletion of the stores of the body vitamin A associated with frequent pregnancies and giving birth and/or due to frequent pregnancies induced iron deficiency anemia which affects hepatic retinol metabolism.

Conclusion

The overall pooled prevalence of night blindness among pregnant mothers in Ethiopia was 19.32%. Pregnant women age greater than 35 years were significantly affected by night blindness. So, strengthening the multivitamin supplementation including vitamin A to reproductive age women is crucial and improving women's married during teenage is an important intervention to tackle maternal night blindness.

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Declaration

Ethical approval

Not applicable because of this study was done using secondary data not primary data

Consent for publication

Not applicable.

Availability of data and materials

The data sets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Authors' Contributions

DS and HE conceived the idea and had major roles in the data review, extraction, and analysis. All authors (TL,MA,YT,GA,BB and SH) contributed to the analysis, writing, drafting, and editing. All the authors read and gave approval of the final version to be published and agreed to be equally accountable for all aspects of the work.

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Competing interest

The authors declare that there are no conflicts of interest.

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Case Report

Imaging findings of head and neck and intracranial sinus histiocytosis with massive lymphadenopathy (Rosai–dorfman disease): A rare case report

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Abstract:

This case report describes a multifocal involvement of Rosai–Dorfman disease (RDD), which is a benign lymphohistiocytosis, with emphasis on imaging findings in a 19 yrs old Ethiopian female patient who was sent to radiology department at Tikur Anbessa Specialized Hospital (TASH) for head and neck and brain imaging evaluations for an indication of bilateral painless neck swelling of 2 years duration. The head and neck computed tomography (CT) and brain magnetic resonance imaging (MRI) revealed numerous enlarged cervical lymph nodes and soft tissue infiltration of paranasal sinuses with associated lytic osseous changes as well as multiple intracranial extra-axial dural-based masses. Smears of fine needle aspiration biopsy from cervical lymph nodes confirmed the diagnosis of Rosai–Dorfman disease (RDD).

Keywords: Rosai- Dorfman disease, cervical lymph nodes, computed tomography, magnetic resonance imaging

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Introduction

Rosai-Dorfman disease (RDD) is a benign lymphohistiocytosis characterized by multiple enlarged cervical lymph nodes. RDD was first described by Desombes in 1965 and was first reported by Juan Rosai and Roland Dorfman as sinus histiocytosis with massive lymphadenopathy in 1969 (1). It is a very rare disease, with a prevalence of 1:200,000 with unknown etiology (2).

RDD tends to affect children and young people (1-3). Most of the patients (83%–95%) present with enlarged cervical lymph nodes (2). Up to 43% of patients show extranodal involvement including the soft tissues of the head and neck, paranasal sinuses, and nasal cavity (3). The central nervous system is involved in less than 5% of the cases, predominantly with extra-axial dural-based masses (1, 4).

The histopathologic findings of RDD include large pale histiocytes with eosinophilic cytoplasm in the background of plasma cells and lymphocytes with emperipolesis (lymphocytophagocytosis) seen in hematoxylin and eosin stain (4). We report imaging

findings of a rare case of RDD with head and neck and intracranial involvement.

Case Presentation

A 19-years-old Ethiopian female patient was referred to TASH for a complaint of bilateral painless neck swelling of 2 years duration for evaluation of head and neck computed tomography (CT) and brain magnetic resonance imaging (MRI). The patient also had multiple nodular facial skin lesions on presentations.

The head and neck CT imaging revealed numerous, bilateral, different sized, discrete and homogeneously enhancing enlarged cervical lymph nodes which involved all cervical lymph node levels. There was also a diffuse soft tissue infiltrative component seen involving the paranasal sinuses (Figure 1). Multiple dural-based intracranial extra-axial masses were also observed on the CT images.

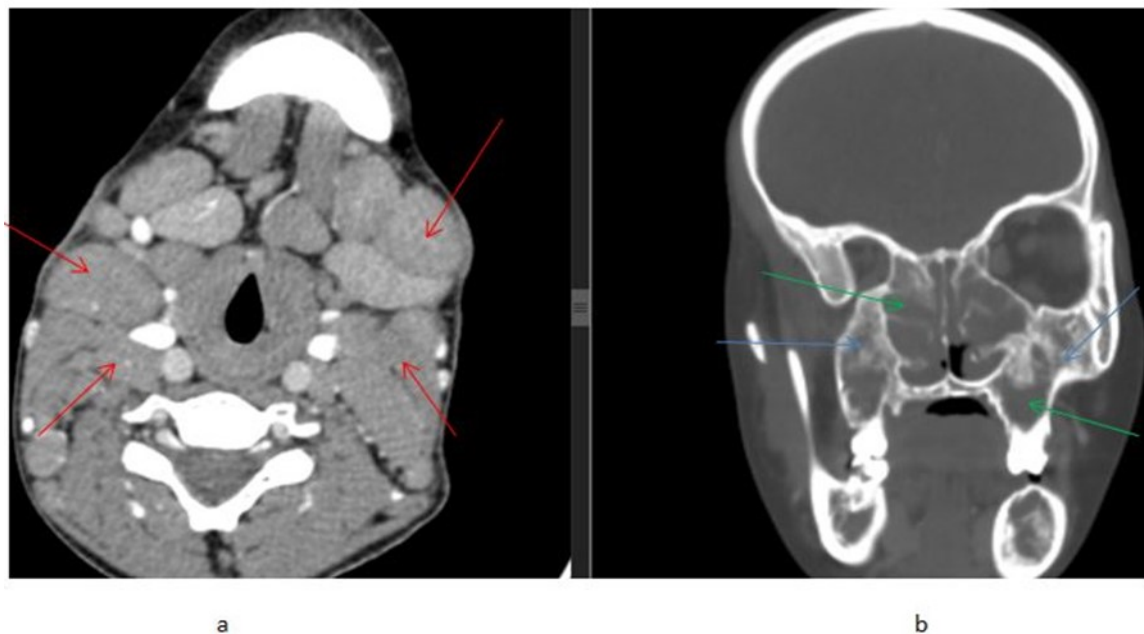


Figure 1 Head and Neck CT (a) axial soft tissue window show bilateral different sized numerous enlarged cervical lymph nodes (red arrows). (b) Coronal plane bone window show opacification of maxillary and ethmoid sinuses (green arrows) and lytic change of maxillary bone (blue arrows).

The head MRI with gadolinium-based intravenous contrast agent revealed multiple intracranial extra-axial well-defined dural-based masses which involve multiple intracranial compartments such as middle and posterior fossa. They involved the right cerebellopontine angle and parasellar region, extending to the right side of cavernous sinus, and the left side of middle cranial fossa. The extra-axial masses showed T1 isointense and T2 hypointense signal (Figure 2) relative to the cortical signal.

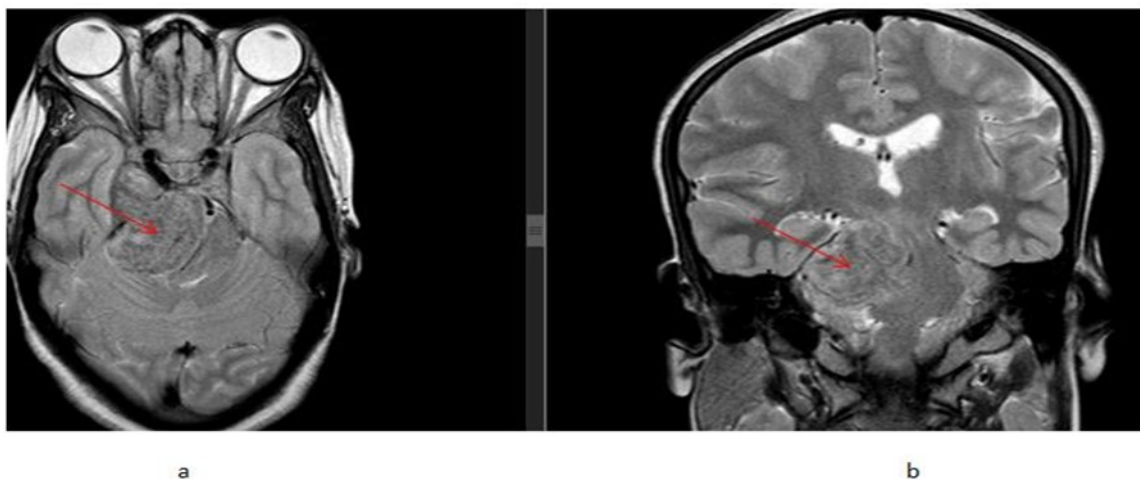


Figure 2: T2 brain MRI, (a) axial and (b) coronal planes showing right side multicompartmental extraaxial dural based hypointense masses (red arrows) in the right prepontine cistern, Meckel's cave and parasellar regions

The intracranial masses showed diffuse avid contrast enhancement on the post-contrast study. There was compression of the adjacent brain parenchyma but no obvious brain parenchymal infiltration or vasogenic edema seen. The intracranial masses also showed extracranial extension through the widened skull base

foramen (Figure 3). Chest x-ray and abdominopelvic ultrasound studies were done for this patient and showed no remarkable findings.

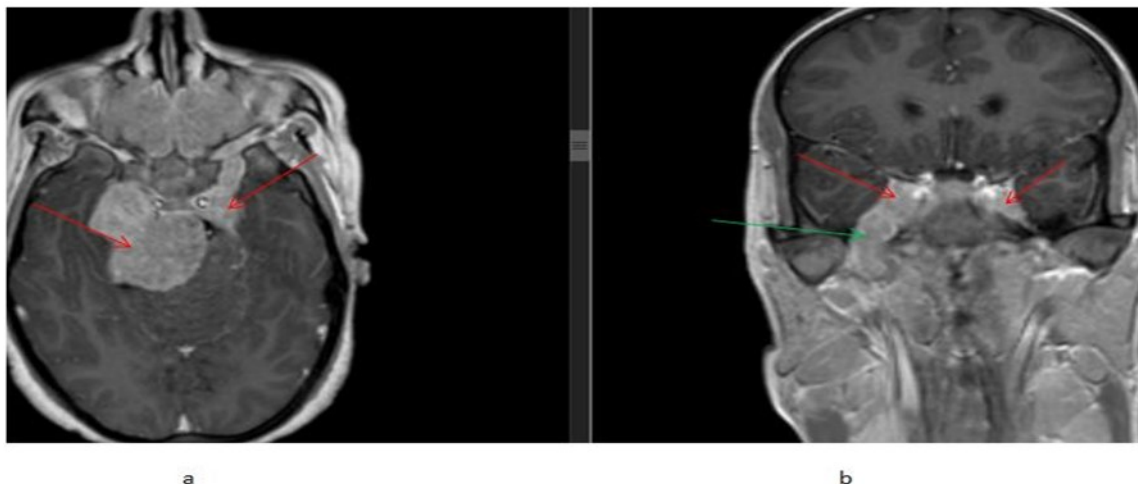


Figure 3 T1 post-contrast brain MRI, (a) axial and (b) coronal planes show multiple well-defined extra-axial dural based diffusely enhancing masses (red arrows) with extracranial extension through right foramen ovale (green arrow).

Fine needle aspiration cytology (FNAC) was done from bilateral neck lymph nodes and smear showed lots of macrophages containing numerous lymphocytes in their cytoplasm. The large histiocytic cells contain engulfed lymphocytes (emperipolesis¹⁸). The findings confirm the diagnosis of RDD.

Discussion

Our case revealed multifocal imaging findings of head and neck and intracranial involvement of a very rare benign disease. A young female patient with diagnosis of RDD after she presented with painless neck swelling and imaging revealed multiple enlarged cervical lymph nodes and intracranial dural based extraaxial masses. Differential diagnosis of lymphoma, metastases and multiple meningiomas were considered based on imaging findings and diagnosis was made only after FNAC was done.

The most common finding in patients with RDD is an enlargement of multiple cervical lymph nodes. This is similar to our case and well described in previous literature and case reports (1-5). This is also well described in previous two retrospective case review studies done by Vaidya et al and La Barge et al (2, 3). The soft tissue infiltration of paranasal sinuses and lytic osseous changes seen in our case, were also reported in previous case reviews (4, 5). The involvement of sinonasal regions is previously mentioned as the second most common site of involvement in RDD (2).

Intracranial involvement of RDD is less common. The common findings in intracranial involvement are multiple extra-axial enhancing masses. This is well described by H. Zhu *et al* and Raslan *et al* in their case reviews (2, 4). The intracranial masses in RDD as described by H. Zhu *et al* tend to be extra-axial, well-circumscribed, and dural-based with T2 iso- to hypointense signal with avid and homogeneous contrast enhancement on post-contrast study similar to our case (4).

The limitation of this case report is that we were not able to retrieve the pathology slides to include representative pathology slide images for we lost them.

Conclusion

RDD could mimic a number of pathologies on imaging, and one has to consider a differential diagnosis especially in patients with multiple cervical lymphadenopathy and other associated findings such as sinonasal soft tissue infiltrations and intracranial extra-axial dural-based masses.

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Ethical clearance and patient consent: Informed consent was waived by the department's IRB as this case report involves analyzing existing data and poses no more than minimal risk for the subject.

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Case Report

Human fascioliasis: A diagnostic challenge in resource limited setting

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Abstract

Fascioliasis, a disease caused by liver flukes. It is one of the neglected zoonotic diseases. There are only a few reports of fascioliasis from Ethiopia and no case with predominant extrahepatic presentation has been reported so far. We report a case of young woman, who presented with a two weeks of dry cough and generalized pruritus. Her workup revealed marked eosinophilia and multiple, hypodense, and hypovascular hepatic lesions. An enzyme-linked assay became positive for Fasciola hepatica. Fasciola hepatica can present with predominant extra hepatic presentation and should be considered in patients presenting with urticaria, skin rash, cough and eosinophilia

Keywords: Human fascioliasis, Fasciola hepatica, Liver Fluke, Eosinophilia, Extrahepatic

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Background

Fascioliasis is a trematode disease caused by two species, fasciola hepatica and fasciola gigantica [1]. It has been predicted that 2.6 million people are infected with Fasciola spp [2]. Despite reported world-wide distribution of fascioliasis, data from Africa is scanty [3]. In Ethiopia, fascioliasis is one of the major livestock diseases, particularly of ruminants [4]. This report describes a young woman presented predominantly with extrahepatic features of fascioliasis.

Case Description

A 34-years-old woman from Addis Ababa presented with a dry cough and pruritus of 2 weeks duration. She developed pruritic urticarial cutaneous lesions involving the whole body sparing her face, palms, and soles. Over the following week, she started to have pain over the mid back and bilateral flank followed by vomiting of ingested and bilious matter. Her symptoms started a month after a leisure-travel to Bishoftu city and remembered eating salad consisting of lettuce and tomato.

On presentation, she was in severe pain and her physical examination was normal. Laboratory revealed white blood cell count of 16,360 cells per microliter with an absolute eosinophil count of 10,550 cells per microliter. Organ function tests, stool examination, urinalysis and pancreatic enzymes were within normal range. Viral markers for hepatitis B and C and HIV were negative. Her chest radiograph was unremarkable.

The initial ultrasound showed multiple small hepatic nodules (Figure 1 A, B) with periportal lymphadenopathies (Figure 1 C, D). Subsequently, abdominal computed tomography (CT) scan with intravenous contrast was obtained and it revealed multiple, ill-defined, hypodense, and hypovascular hepatic lesions (Figure 2A-E).

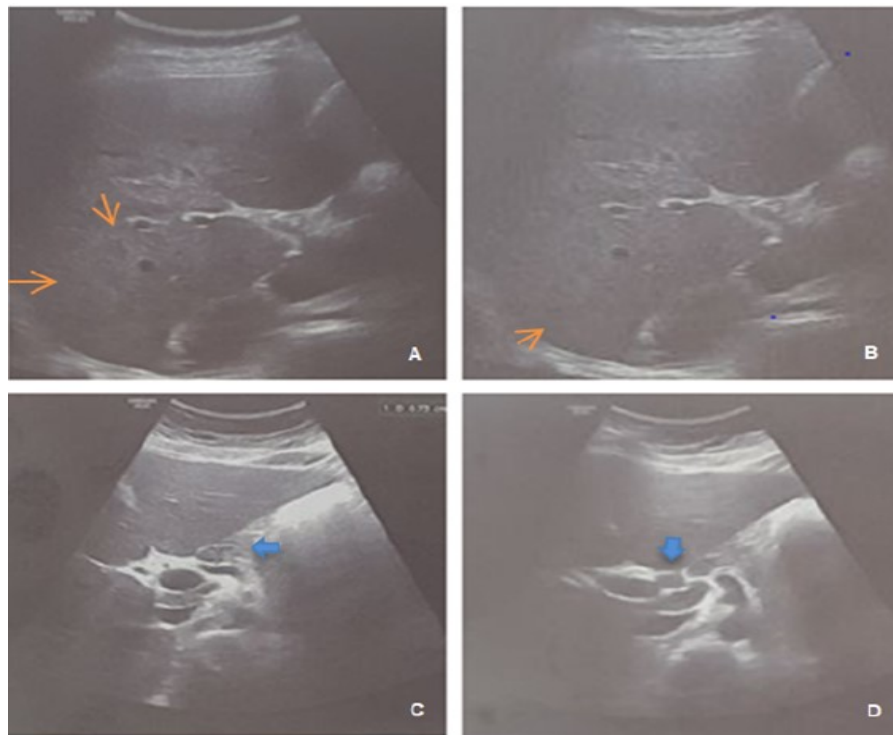


Figure 1: A & B show multiple hepatic nodules involving a few hepatic segments (orange arrows) with multiple periportal lymphadenopathies noted (blue arrows) as seen in C & D

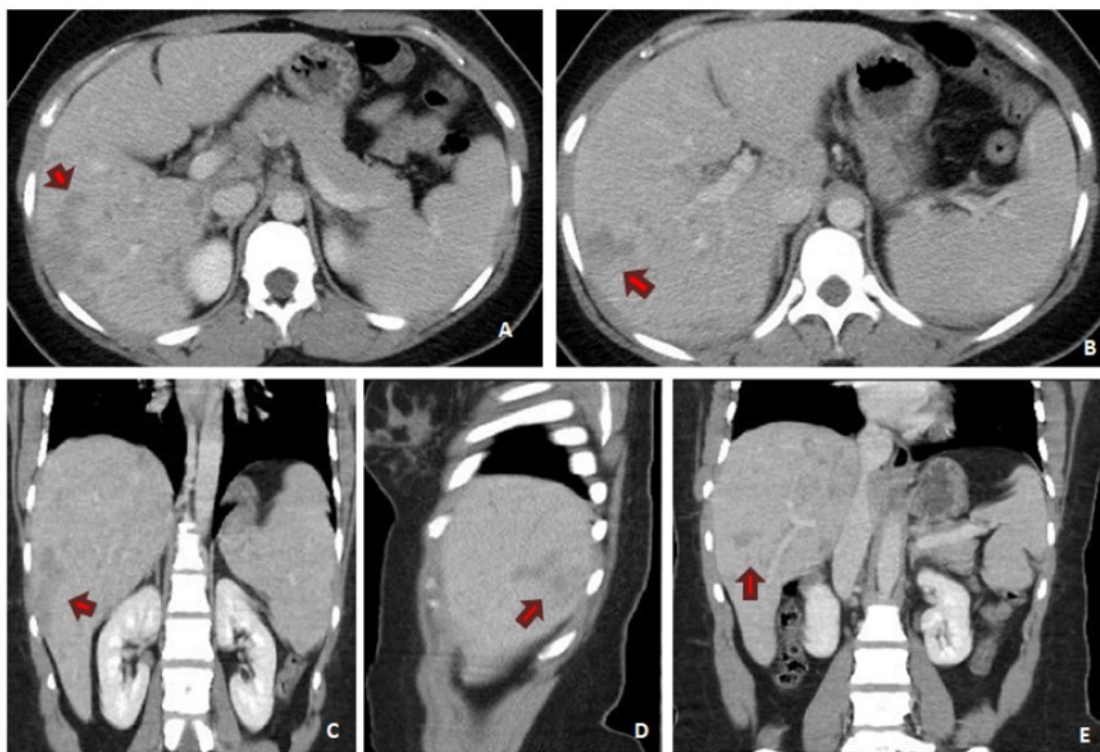


Figure-2: (A-E) Multiple, variable sized, ill-defined hypo-enhanced hepatic lesions affecting predominantly the right lobe (red arrows). The lesions are mainly peripheral but have periportal and perivascular best seen in the portal venous phase (red arrows) with progressive enhancement in the delayed phase.

In light of the patient's travel history and eosinophilia, serologic workups were pursued. Repeated stool examinations were non-revealing. Serologic results became negative for *Toxocara canis* antibody (IgG) and *fasciola hepatica* IHA was reported positive with a titer of 1:2560 (Ref. Range < 1:160) and *fasciola hepatica* IgG of 39.9U/ml (Ref. Range < 9.0U/ml) confirming the diagnosis of *fasciola hepatica*.

Oral triclabendazole was started and she had clinical improvement including the resolution of cough, pruritus, skin lesions and the pain. Weekly monitoring of eosinophil count and abdominal ultrasound showed a progressive decline. After 3 weeks the eosinophil count dropped to 1830 cells per microliter and -liver nodules disappeared.

Discussion

Human fascioliasis is a food-borne trematode infection. Humans are incidental hosts and become infected by ingesting raw fresh plants carrying metacercariae [1]. Fascioliasis has two clinical phases, the initial acute (liver) phase and the chronic (biliary) phase. The acute phase is due to damage to hepatocytes directly from the mature flukes. At this stage patients present with fever, anorexia, nausea, vomiting, right upper quadrant pain, and hepatitis. Allergic and immunologic responses may result in Leofflers syndrome, pruritic urticaria, pericarditis, and meningitis. Marked peripheral eosinophilia is almost always present [6, 7].

The chronic phase results from obstruction of the biliary tree and resultant inflammation. It is characterized by intermittent biliary colic, jaundice, and diarrhea. The chronic phase can be complicated by cholangitis, cholelithiasis, and obstructive jaundice. Pancreatitis is also reported in 30 percent of cases [6].

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There is no gold standard diagnostic modality for fascioliasis [8]. The diagnosis is made by positive serology and imaging that reveals acute, hypodense liver lesions that change over time [9]. On imaging small, multiple, nodular lesions are suggestive of fascioliasis. These lesions are hypoechoic on ultrasound, hypodense on CT scan, and T2 hyper- and T1 hypointense on magnetic resonance imaging (MRI) [10].

Triclabendazole is the drug of choice for its effectiveness against both adult and immature worms. Bithionol and nitazoxanide are alternative choices [6].

Conclusion

Human fascioliasis has variable clinical presentation and may mimic many clinical conditions. Infestations with parasites are frequent in developing countries. However, they are often misdiagnosed as other conditions. Maintaining a high index of suspicion is very important in reaching the diagnosis. The presence of allergic manifestations and eosinophilia should mandate a consideration of acute fascioliasis in at risk individuals.

Ethical issues

Written informed consent was obtained from the patient for publication of this case and related photographic evidence.

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We are grateful to our patient for providing the necessary information.

Disclosure

The authors report no conflicts of interest.

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