Knowledge and associated factors towards diabetes mellitus among adult non-diabetic community members of Gondar city, Ethiopia 2019

Abiy Maru Alemayehu1*, Henok Dagne2, Baye Dagnew3

1 Department of Optometry, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia, 2 Department of Environmental and Occupational Health and Safety, Institute of Public Health, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia, 3 Department of Human Physiology, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia

* These authors contributed equally to this work.

atinkutmar@gmail.com

Abstract

Introduction

Diabetes mellitus is a metabolic disorder resulting from either loss of insulin producing cells, insufficient insulin action, or both. Knowledge can play an important role in preventing diabetes mellitus and its complications. There is limited information regarding knowledge and related factors regarding diabetes mellitus among non-diabetic adult community members in the study area. Therefore, the current study aimed to determine knowledge and associated factors towards diabetes mellitus among non-diabetes community members of Gondar city.

Methods

Community-based cross-sectional study was conducted on non-diabetic community members from July 1–29, 2019 in Gondar city. The participants were selected randomly from each households. A structured questionnaire was used to collect the data. EpiData version 3.1 was used for data entry and SPSS version 20 was used for data processing and analysis. Descriptive statistics were calculated for most variables. Multivariable logistic regression was used to identify the associated factors. A variable was considered significantly associated at p-value <0.05.

Result

A total of 633 study subjects participated in this study with a mean age of 36.12 (± 12.87) years. Of these study participants, 572 had awareness about diabetes mellitus and 51.4% (95% CI: 47.4%, 55.8%) had good knowledge. Being male [Adjusted odds ratio = 1.62 (95% CI: 1.05, 2.48)], monthly income of 3000–5000 birr [Adjusted odds ratio = 1.88 (95% CI: 1.03, 3.41)], monthly income of ≥5001 birr [Adjusted odds ratio = 2.37 (95% CI: 1.17, 4.78)], previous training on diabetes mellitus [Adjusted odds ratio = 4.37 (95% CI: 3.04, 7.37)], being grade 9–12 [Adjusted odds ratio = 3.1 (95% CI: 1.09, 8.66)], having college and above
educational qualification [Adjusted odds ratio = 3.70 (95% CI: 1.26, 10.85)] were significantly associated with good knowledge towards diabetes mellitus.

**Conclusion**

The level of knowledge regarding diabetes mellitus was low among study participants which indicates a need for health education intervention. Previous training on diabetes mellitus, educational status and average monthly income and being male were the factors associated with good knowledge of participants about diabetes mellitus.

**Introduction**

Diabetes mellitus (DM) is a metabolic disorder which is characterized by increased blood glucose level with disturbances of carbohydrate, fat and protein metabolism resulting from either loss of insulin producing cells, insufficient insulin action, or both [1]. World health organization (WHO) projects the number of patients with diabetes mellitus to be 366 million by the year 2030 which is more in low- and middle-income countries [2]. However, the International Diabetes Federation estimates this number to be 472 million by 2030 which indicates how the prevalence increases from time to time[3]. It is one of the public health threats in the world. Diabetes is an important public health problem, one of four priority non-communicable diseases targeted for action by world leaders, that leads to visual impairment, heart attack, stroke, kidney dysfunction, amputation, and nerve damage [4]. Diabetes leads to blinding ocular problems if it is left undiagnosed in the early stage and not treated accordingly [5]. In addition to its physical complications among individuals, DM has several negative impact on the nation’s economy [4].

Most societies lack awareness about DM and its tremendous complications [5]. Creating awareness can enabling a population to have a better understanding of DM. Thus, it can help in reducing the complications, unwanted impact of the condition and health care costs due to DM. Awareness creation programs about DM have always helped to prevent and manage DM [6,7].

Knowledge about DM can play an important role to encourage the community for the prevention and minimization of complications due to DM [7,8].

A great variation exists in knowledge towards DM among community members, but the reasons are not clear. However the level of knowledge towards DM has been associated with socio-demography, educational status [9], family history of DM [10], previous training on DM, source of information and other factors.

Although it is a common public health problem, there was no sufficient data about knowledge and associated factors towards DM in the study area among non-diabetic community members. Therefore, this study aimed to determine knowledge and factors towards diabetes mellitus among non-diabetic individuals.

**Methods and materials**

**Study design, area and period**

A community-based cross-sectional study was conducted in Gondar city, Northwest Ethiopia, from July 1–29, 2019. Information obtained from Central Gondar zone administration finance and economic office indicated that, Gondar city is located in the Central Gondar zone which is situated 748 km from the capital city, Addis Ababa. According to the office, it had a population of 351, 675 divided into 10 sub-cities and 24 kebeles (smallest administrative units in Ethiopia) [11]. There was one government hospital that is University of Gondar comprehensive specialized hospital.
Source and study population

All adult non-diabetic community members living in Gondar city who were present at households during the data collection period.

Inclusion and exclusion criteria

Inclusion criteria. All adult non-diabetic community members in Gondar city who were found at home during the data collection period

Exclusion criteria. Diabetic patients and patients with other chronic systemic illness

Sample size determination

The sample size was calculated by taking variability of proportion from a similar study which was 52.5% for knowledge [12]. Taking 351,675 community members as source population and using Open Epi software package for the determination of sample size, which uses the formula given below for the finite population [13], the final sample size was calculated as:

\[
 n = \frac{Nz^2pq}{d^2(N - 1) + z^2pq}
\]

Where \( n \) = sample size
\( N \) = source population
\( P \) = proportion of knowledgeable non-diabetic community
\( d \) = margin of error
\( z \) = Value of z statistic at 95% confidence interval = 1.96

The sample size became 383.

After considering 10% non-response rate for any unpredictable events and design effect of 1.5, the final required sample size was 633.

Sampling technique and procedures

To ensure representativeness, the sample was taken from about 25% of the total 24 kebeles. Six kebeles were selected using the lottery method. In the selected 6 kebeles there were a total of 16,396 households. A list of each household was taken from each Kebele administration. The study participants were selected using a systematic random sampling technique by calculating the intervals \( K \) using the formula \( K = N/n \), i.e. \( 16,396 / 633 = 26 \)

Where, \( n \) = sample size, \( N \) = total number of households as listed from each kebele. Consequently, by selecting one house out of 26 households using the lottery method as a starting point every 26th house was used to conduct the study directly. If the selected household is inaccessible, the next household was included. When more than one study participants found in the selected household, the lottery method was used to select one participant. The interview was conducted after receiving permission from the household heads.

Fig 1. The diagrammatic representation of the sampling procedure and technique.

The study was conducted after ethical clearance was obtained from the ethical review board of the University of Gondar with the reference number of V/P/RCS/05/2030/3019. Officials at the school of Medicine and Gondar city administration were communicated through formal letters that was obtained from the ethical review board of the University of Gondar. Written informed consent was obtained from each study participants. Participants were informed about the objective of the study and their full right to discontinue or refuse to participate in the study. The confidentiality of the information obtained was assured through anonymity.
Operational definition

**Good knowledge**: Individuals who responded the mean (19.37) and above of the total knowledge questions had good knowledge about diabetes mellitus.

**Poor knowledge**: Individuals who responded below the mean (19.37) of the total knowledge questions had poor knowledge about diabetes mellitus.
Awareness: A participants were classified as being aware of diabetes mellitus if a positive response ('Yes') is obtained to the question 'have you ever heard of diabetes mellitus?'

Non-diabetic community member: A portion of a community member who had no known history of diabetes mellitus.

Adult: A person older than 18 years of age.

Household: A person or group of related or unrelated persons who lived together in the same dwelling unit(s), who acknowledge one adult male or female as the head of the household, who shared the same housekeeping arrangements, and who were considered a single unit [14].

Data collection procedures and personnel
A pre-tested structured interviewer administered questionnaire was used after reviewing different works of literature [10,12,15–17]. The questionnaire covered demographic information and general knowledge about diabetes. The reliability of the questionnaire was checked by conducting a pretest in Bahirdar city, which had similar characteristics with Gondar city, by taking 5% of the sample size. From the pretest, understandability, clarity, and organization of the questionnaire were checked. From the reliability test of knowledge questions, 0.868 Cronbach’s alpha value was found. The questionnaire with 31 point scale items was prepared in English language and then translated to Amharic (local language in Gondar city) that was used for data collection and re-translated back to English to check its consistencies. The questionnaire was then refined accordingly for final use. The interview was conducted on selected households. Eight trained optometrists have participated in data collection.

The knowledge of study participants about diabetes mellitus was assessed using 31 point scale items. There were 31 multiple choice questions that carried a total of 31 correct responses. Each correct response was given a score of 1 and a wrong response a score of 0. Total points to be scored were 31 and the minimum score was 0. Previous studies were used for the classification of study participants’ knowledge level. With a score of mean and above meant a good knowledge and poor knowledge for a score less than mean [10,12].

Data quality control
Data were collected after training was given for data collectors on how to interview participants. On the field-work, the supervisor closely followed the day-to-day data collection process and ensure the completeness of the collected data. Finally, 5% of the collected samples were checked by the principal investigator daily.

Data processing and analysis
After cleaning and coding, the data were entered into EPIData version 3.1 and exported to and analyzed using SPSS version 20. Proportions, rates and summary statistics such as mean, the standard deviation were calculated for most variables. Multivariable logistic regression was used to determine the factors associated with knowledge towards diabetes mellitus by entering all independent variables in to the model. The variables with a p-value of less than 0.05 were considered statically significant associated with the outcome.

Results
Socio-demographic characteristics of the study participants
A total of 633 study participants took part in the study. About 9.6% were not aware of diabetes mellitus. Therefore, the analysis was done for the remaining 90.4% of participants who were aware of diabetes mellitus. Among them, 52.6% (301) were females. The mean age of the study
participants was 35.49 years (± 12.36 years). Close to half of the study participants (48.3%) had college and above educational status (Table 1).

**Knowledge towards diabetes mellitus**

Out of 572 study participants, 294 (51.4%) (95% CI: 47.4, 55.8) had good knowledge. Most study participants defined diabetes as the presence of high blood sugar levels in the body (78.7%), but nearly half of the study participants did not know DM as a condition of insufficient insulin production. Study participants mentioned being obese (70.5%) as the major risk factor for the development of diabetes. Polyphagia (88.5%), feeling of tiredness (78.1%), and the presence of high blood sugar levels (78.3%) were reported as symptoms of DM (Table 2).

**Table 1. Socio-demographic characteristics and source of information of study participants in Gondar city, Northwest Ethiopia, 2019 (n = 633).**

| Variables                              | Frequency | Percent |
|----------------------------------------|-----------|---------|
| Have heard of diabetes mellitus        |           |         |
| Yes                                    | 572       | 90.4    |
| No                                     | 61        | 9.6     |
| Sex                                    |           |         |
| Female                                 | 271       | 47.4    |
| Male                                   | 301       | 52.6    |
| Age category in years                  |           |         |
| ≤ 24                                   | 101       | 17.7    |
| 25–30                                  | 153       | 26.7    |
| 31–40                                  | 159       | 27.8    |
| ≥ 41                                   | 159       | 27.8    |
| Educational status                     |           |         |
| Cannot read and write                  | 33        | 5.8     |
| Can read and write                     | 64        | 11.2    |
| Grades 1–8                             | 34        | 5.9     |
| Grades 9–12                            | 165       | 28.8    |
| College and above                      | 276       | 48.3    |
| Occupational status                    |           |         |
| House wife                             | 86        | 15.1    |
| Student                                | 98        | 17.1    |
| Merchant                               | 120       | 21.0    |
| Farmer                                 | 17        | 3.0     |
| Civil servant                          | 214       | 37.4    |
| Daily laborer                          | 37        | 6.5     |
| Monthly income in ETB                  |           |         |
| ≤ 1999                                 | 86        | 15.1    |
| 2000–2999                              | 145       | 25.3    |
| 3000–5000                              | 235       | 41.1    |
| ≥ 5001                                 | 106       | 18.5    |
| Previous training on DM                |           |         |
| Yes                                    | 178       | 31.1    |
| No                                     | 394       | 68.9    |
| Family history of DM                   |           |         |
| Yes                                    | 79        | 138     |
| No                                     | 493       | 86.2    |

[https://doi.org/10.1371/journal.pone.0230880.t001](https://doi.org/10.1371/journal.pone.0230880.t001)
Factors associated with the proportion of knowledge towards diabetes mellitus

Sex, previous training about diabetes mellitus, age, monthly income, educational status, occupational status and presence of a person with diabetes mellitus in the family were entered into the multivariable analysis. Sex being male, an income of 3000–5000 Ethiopian Birr (ETB), 5001 and above, previous history of training on diabetes mellitus and educational status of grades 9–12 and college and above were associated significantly with knowledge (Table 3).
Table 3 shows that the odds of good knowledge regarding diabetes mellitus among male study participants were 1.62 times greater than the odds of good knowledge for women [AOR = 1.62 (95% CI: 1.05, 2.48)].

The odds of good knowledge regarding diabetes mellitus among study participants who had an income of 3000–5000 ETB were 1.88 times greater than the odds of good knowledge among subjects with an income of ≤ 1999 ETB [AOR = 1.88 (95% CI: 1.03, 3.41)]. The odds of good knowledge regarding diabetes mellitus among study participants who had an income of ≥5001 ETB were 2.37 times greater than the odds of good knowledge for those subjects with the income of ≤ 1999 ETB [AOR = 2.37 (95% CI: 1.17, 4.78)].

The odds of good knowledge regarding diabetes mellitus among study participants who had previous training on diabetes mellitus were 4.74 times greater than the odds of good knowledge among study participants who had previous training on diabetes mellitus [AOR = 4.74 (95% CI: 3.04, 7.37)].

### Table 3. Factors associated with knowledge of study participants regarding diabetes mellitus in Gondar city, Northwest Ethiopia, 2019 (n = 572).

| Variables                        | Knowledge | AOR (95% CI) | P-value |
|----------------------------------|-----------|--------------|---------|
|                                  | Good      | Poor         |         |
| Sex                              |           |              |         |
| Female                           | 137       | 164          | 1.00    |
| Male                             | 157       | 114          | 1.62 (1.053, 2.48) | 0.028 |
| Age in years                     |           |              |         |
| ≤ 24                             | 51        | 50           | 1.53 (0.89, 2.62) | 0.123 |
| 25–30                            | 79        | 74           | 1.01 (0.57, 1.81) | 0.967 |
| 31–40                            | 93        | 66           | 0.75 (0.27, 1.22) | 0.149 |
| ≥41                              | 71        | 88           | 1.00    |
| Monthly income in ETB            |           |              |         |
| ≤ 1999                           | 31        | 55           | 1.00    |
| 2000–2999                        | 61        | 84           | 1.56 (0.61, 2.19) | 0.652 |
| 3000–5000                        | 136       | 99           | 1.88 (1.03, 3.41) | 0.038 |
| ≥5001                            | 66        | 40           | 2.37 (1.17, 4.78) | 0.016 |
| Educational status               |           |              |         |
| Can’t read and write             | 9         | 24           | 1.00    |
| Can read and write               | 16        | 48           | 0.64 (0.22, 1.86) | 0.410 |
| Grade 1–8                        | 15        | 19           | 2.03 (0.62, 6.65) | 0.242 |
| Grade 9–12                       | 89        | 76           | 3.10 (1.09, 8.66) | 0.033 |
| College and above                | 165       | 111          | 3.70 (1.26, 10.85) | 0.017 |
| Occupational status              |           |              |         |
| House wife                       | 32        | 54           | 1.00    |
| Student                          | 61        | 37           | 1.30 (0.53, 3.18) | 0.561 |
| Merchant                         | 58        | 62           | 0.58 (0.28, 1.19) | 0.139 |
| civil servant                    | 121       | 93           | 0.69 (0.33, 1.46) | 0.334 |
| Daily laborer                    | 22        | 32           | 0.81 (0.34, 1.97) | 0.653 |
| Previous training about DM       |           |              |         |
| No                               | 164       | 230          | 1.00    |
| Yes                              | 130       | 48           | 4.74 (3.04, 7.37) | 0.000 |
| Family history of DM             |           |              |         |
| No                               | 240       | 253          | 1.00    |
| Yes                              | 54        | 25           | 1.77 (0.99, 3.13) | 0.052 |

AOR = Adjusted Odds ratio, 1.00 = Reference

https://doi.org/10.1371/journal.pone.0230880.t003
knowledge for study subjects with no history of training on diabetes mellitus [AOR = 4.37 (95% CI; 3.04, 7.37)]. The odds of good knowledge regarding diabetes mellitus among subjects who were grades 9–12 were three times greater than the odds of knowledge for subjects who could not read and write [AOR = 3.1 (95% CI: 1.09, 8.66)]. Similarly, the odds of good knowledge regarding diabetes mellitus among subjects who had college and above educational qualifications were four times greater than the odds of knowledge for subjects who could not read and write [AOR = 3.70 (95% CI: 1.26, 10.85)].

Discussion
This community based cross-sectional study was conducted to determine the knowledge and identify associated factors of the non-diabetic adult community members regarding diabetes mellitus in Gondar city. In this study 294 (51.4%) (95% CI: 47.4, 55.8) non-diabetic adult community members had good knowledge of diabetes mellitus. This finding was in line with studies conducted in Bale zone administrative town (52.5%), Debretabor town (49%) and India (49.9%) [10,12,18]. The possible reason might be due to the similarity of the study design used, which was a community-based study. But it was lower than the study conducted in Kemissie and Kombolcha towns, Ethiopia [19]. This might be due to the difference in the study population in which the study conducted in kemissie and Kombolcha assess the knowledge levels separately among subjects with and without diabetes family members. In addition to this, it was lower than knowledge level reported in the studies done in India [20], Sri Lanka [21] and Saudi Arabia [9]. This could be due to measurement differences. The study conducted in Saudi Arabia measured the level of knowledge using awareness. On the other hand this result is higher than the study conducted in Kenya(27.2%) [22], India (9.2%) [23] and Sudan(15%) [24]. This discrepancy might be due to the sociocultural difference between these populations. The other possible explanation might be the studies conducted in Kenya, India and Sudan, respondents were from rural setup who may lack adequate information regarding diabetes mellitus.

In this study, a significant number of study participants (9.6%) were not aware of diabetes mellitus. Lack of awareness about diabetes mellitus is common in the poor and illiterate segment of the population as indicated by the study done in Pakistan [17]. The lack of awareness and the knowledge gap existed in the community may increase the burden of the condition. This also indicates the need to advocate on diabetes mellitus to promote public health.

The odds of good knowledge regarding diabetes mellitus among study participants who had previous training on diabetes mellitus were five times greater than the odds of good knowledge for study subjects with no history of training on diabetes mellitus. This finding is agreed with another study done in Bale [12]. This may be due to the fact that training is one of the methods to boost knowledge towards diabetes mellitus as indicated in the research done in Indonesia [7].

The odds of good knowledge regarding diabetes mellitus among study participants who had an income of 3000–5000 ETB were two times greater than the odds of good knowledge for study subjects who had an income of ≤ 1999 ETB. In addition to this, the odds of good knowledge regarding diabetes mellitus among study participants who had an income of 5001 and above ETB were two times greater than the odds of good knowledge for study subjects who had an income of ≤ 1999 ETB. This finding is in line with the studies done in Mekelle and Debre Tabor, Ethiopia [8,10], Bangladesh [25] India [18], and Pakistan [17]. Upper socioeconomic status may increase the exposure of individuals to information about diabetes mellitus. That is why a high level of income has a positive association with knowledge towards diabetes mellitus.

The odds of good knowledge regarding diabetes mellitus among study participants who had the educational status of grades 9–12 were three times greater than the odds of good...
knowledge for study subjects who could not read and write. And also, the odds of good knowledge regarding diabetes mellitus among study participants who had educational qualifications of college and above were four times greater than the odds of good knowledge for study subjects who could not read and write. This study is comparable with the studies done in Ethiopia [8,19], Sri Lanka [21], Bangladesh [25,26] and Pakistan [17,27]. This may be because of improvement of acquisition of knowledge as the level of education increases.

The odds of good knowledge regarding diabetes mellitus among male study participants was 1.6 times greater than the odds of good knowledge among females. This is in line with the studies done in Bangladesh [26] and Pakistan [17]. Better knowledge about DM was also reported among males in Karachi [15]. The possible explanation may be due to the socio-cultural influence in the community, which indicates the exposure of males for information than females in the study area. Since males are mainly engaged in outdoor activities, the likelihood of exposure to health related information might be higher compared to females. Whereas females are mainly involved in indoor activities [28]. Data from the 2011 Ethiopia demographic and health survey also indicates that 47% of males were exposed to information compared to only 32% females [29]. Significantly higher knowledge scores among males than females may also be related to a higher level of education among males [17]. In this study the illiteracy rate of males was 1.22% as compared to females which was 4.55%. This may again explain why males are more knowledgeable than females towards diabetes mellitus. However in a study conducted in the Bale zone, Ethiopia, sex was not significantly associated with knowledge towards diabetes mellitus [12].

**Limitation of the study**

Like most other health studies data from cross sectional studies, by its nature had a defect to detect causes and effect relationships of conditions. Since the study unit was household base, homeless and street individuals were excluded which could affect its generalizability.

**Conclusion**

This study showed that only about half the non-diabetic community in Gondar city had good knowledge regarding diabetes mellitus. Previous training on diabetes mellitus, educational status and monthly family income and being male were the factors associated with good knowledge of participants about diabetes mellitus.

**Supporting information**

*S1 File. Questionnaire and data extraction form to determine knowledge and associated factors towards diabetes mellitus among adult non-diabetes community members of Gondar city, Ethiopia 2019.*

(DOCX)

*S1 Data. Original data set.*

(SAV)

**Acknowledgments**

We would like to acknowledge the University of Gondar for technical support to conduct this research.
Author Contributions

Conceptualization: Abiy Maru Alemayehu, Henok Dagne, Baye Dagnew.

Data curation: Abiy Maru Alemayehu, Henok Dagne.

Formal analysis: Abiy Maru Alemayehu.

Investigation: Abiy Maru Alemayehu, Henok Dagne, Baye Dagnew.

Methodology: Abiy Maru Alemayehu, Baye Dagnew.

Project administration: Abiy Maru Alemayehu.

Resources: Abiy Maru Alemayehu, Henok Dagne.

Software: Baye Dagnew.

Supervision: Abiy Maru Alemayehu, Baye Dagnew.

Writing – original draft: Abiy Maru Alemayehu.

Writing – review & editing: Abiy Maru Alemayehu, Henok Dagne, Baye Dagnew.

References

1. Alberti KGMM, Zimmet Pf (1998) Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: diagnosis and classification of diabetes mellitus. Provisional report of a WHO consultation. Diabetic medicine 15: 539–553. https://doi.org/10.1002/(SICI)1096-9136(199807)15:7<539::AID-DIA668>3.0.CO;2-S PMID: 9686693

2. Wild S, Roglic G, Green A, et al. (2004) Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. Diabetes care 27: 1047–1053. https://doi.org/10.2337/diacare.27.5.1047 PMID: 15111519

3. Aguiree F, Brown A, Cho N, et al. (2013) International diabetes federation diabetes atlas. Brussels: International Diabetes Federation.

4. World Health Organization (2016) Global report on diabetes. World Health Organization. https://doi.org/10.2337/db15-0956

5. World Health Organization (2005) Prevention of blindness from diabetes mellitus: report of a world health organization consultation World Health Organization. 924154712 X 924154712X.

6. Green LW, Brancati FL, Albright A, et al. (2012) Primary prevention of type 2 diabetes: integrative public health and primary care opportunities, challenges and strategies. Family practice 29: i13–i23. https://doi.org/10.1093/fampra/cm2126 PMID: 22399542

7. Hartayu TS, Mi MI, Suryawati S (2012) Improving of type 2 diabetic patients' knowledge, attitude and practice towards diabetes self-care by implementing Community-Based Interactive Approach-diabetes mellitus strategy. BMC research notes 5: 315. https://doi.org/10.1186/1756-0500-5-315 PMID: 22721433

8. Berke K, Gebru H, Kahsay H, et al. (2014) Assessment of Diabetes Knowledge and its Associated Factors among Type 2 Diabetic Patients in Mekelle and Ayder Referral Hospitals, Ethiopia. J Diabetes Metab 5: 378. https://doi.org/10.4172/2155-6156.1000378 Page 2 of 7 J Diabetes Metab ISSN: 2155-6156 JDM, an open access journal Volume 5 Issue 5 1000378. study participants 171: 3.

9. Bani IA (2015) Prevalence, knowledge, attitude and practices of diabetes mellitus among Jazan population, Kingdom of Saudi Arabia (KSA). Journal of diabetes mellitus 5: 115.

10. Asmamaw A, Asres G, Negese D, et al. (2015) Knowledge and attitude about diabetes mellitus and its associated factors among people in Debre Tabor town, Northwest Ethiopia: cross sectional study. Science 3: 199–209.

11. Gondar Finance and Economy directory (2017) Population Census projection in 2017. Gondar Finance and Economic office.

12. Kassahun CW, Mekonen AG (2017) Knowledge, attitude, practices and their associated factors towards diabetes mellitus among non diabetes community members of Bale Zone administrative towns, South East Ethiopia. A cross-sectional study. PloS one 12: e0170040. https://doi.org/10.1371/journal.pone.0170040 PMID: 28152066

13. Daniel WW, Wayne WD (1995) Biostatistics: a foundation for analysis in the health sciences.
14. Central statistical agency (2016) Ethiopian demographic and health survey.

15. Memon MS, Shaikh SA, Shaikh AR, et al. (2015) An assessment of knowledge, attitude and practices (KAP) towards diabetes and diabetic retinopathy in a suburban town of Karachi. Pakistan journal of medical sciences 31: 183. https://doi.org/10.12669/pjms.311.6317 PMID: 25878640

16. Masood I, Saleem A, Hassan A, et al. (2016) Evaluation of diabetes awareness among general population of Bahawalpur, Pakistan. primary care diabetes 10: 3–9. https://doi.org/10.1016/j.pcd.2015.06.004 PMID: 26137919

17. Gilliani A, Amirul Islam F, Hayat K, et al. (2018) Knowledge, Attitudes and Practices Regarding Diabetes in the General Population: A Cross-Sectional Study from Pakistan. International journal of environmental research and public health 15: 1906.

18. Rani P, Raman R, Subramani S, et al. (2008) Knowledge of diabetes and diabetic retinopathy among rural populations in India, and the influence of knowledge of diabetic retinopathy on attitude and practice. Rural Remote Health 8: 838. PMID: 18656993

19. Wolde M, Berhe N, Die I, et al. (2017) Knowledge and practice on prevention of diabetes mellitus among Diabetes mellitus family members, in suburban cities in Ethiopia. BMC research notes 10: 551. https://doi.org/10.1186/s13104-017-2871-7 PMID: 29096704

20. Rathod GB, Rathod S, Parmar P, et al. (2014) Study of knowledge, attitude and practice of general population of Waghodia towards Diabetes mellitus. International Journal of Current Research and Review 6: 63.

21. Herath HM, Weerasinghe N, Dias H, et al. (2017) Knowledge, attitude and practice related to diabetes mellitus among the general public in Galle district in Southern Sri Lanka: a pilot study. BMC public health 17: 535. https://doi.org/10.1186/s12889-017-4459-5 PMID: 28571566

22. Maina WK, Ndegwa ZM, Njenga EW, et al. (2010) Knowledge, attitude and practices related to diabetes among community members in four provinces in Kenya: a cross-sectional study. Pan African Medical Journal 7.

23. Sristi S, Sheeladevi S, Rani PK (2015) Knowledge, attitude and practices on diabetes and diabetic retinopathy of rural population from an Indian state. International Journal of Diabetes in Developing Countries 35: 33–38.

24. Balla SA, Ahmed HA, Awadelkareem MA (2014) Prevalence of diabetes, knowledge, and attitude of rural, population towards diabetes and hypoglycaemic event, Sudan 2013. Am J Health Res 2: 356–360.

25. Fatema K, Hossain S, Natasha K, et al. (2017) Knowledge attitude and practice regarding diabetes mellitus among Nondiabetic and diabetic study participants in Bangladesh. BMC public health 17: 364. https://doi.org/10.1186/s12889-017-4285-9 PMID: 28446194

26. Islam FMA, Chakrabarti R, Dirani M, et al. (2014) Knowledge, attitudes and practice of diabetes in rural Bangladesh: the Bangladesh population based diabetes and eye study (BPDES). PLoS One 9: e110368. https://doi.org/10.1371/journal.pone.0110368 PMID: 25313643

27. Zuhaid M, Zahir KK, Diju IU (2012) Knowledge and perceptions of diabetes in urban and semi urban population of Peshawar, Pakistan. Journal of Ayub Medical College Abbottabad 24: 105–108.

28. Gebregeorgis MY (2016) Gender construction through textbooks: The case of an Ethiopian primary school English textbook. Africa Education Review 13: 119–140.

29. ICF International (2012) Atlas of Gender and Health Indicators: Data from the 2011 Ethiopia Demographic and Health Survey. Calverton, Maryland, USA: ICF International.