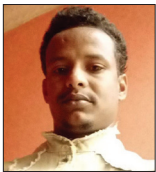*Original Article*

Association between socio-demographic factors and blood groups with risk of diabetes mellitus in Dangila hospital, Awi Zone, North West Ethiopia

H. Berhanie[1], Z. Mihretie[2], K. T. K. Anandapandian[1]

[1]Department of Biology, Bule Hora University, Bule Hora, [2]Department of Biology, Bahir Dar University, Bahir Dar, Ethiopia.

*Corresponding author:
H. Berhanie,
Department of Biology, Bule
Hora University, Blue Hora,
Ethiopia.

berhaniehailu@gmail.com

Quick Response Code:

ABSTRACT

Introduction: Diabetes mellitus (DM) is a metabolic disease which is categorized as hyperglycemia. This disease is a multi-factorial trait that appears by interactions of genetic, immunological, and environmental factors.

Materials and Methods: The study was conducted through case–control method of study in Dangila, Ethiopia. The total number of individuals included as study subjects was 403, of these 201 were diabetic patients (81 type I and 120 type II diabetic patients) and 202 were non-diabetics patients. From 403 participants, 225 were males and 178 were females. The data were analyzed using SPSS version 21.0.

Results: A significant association was obtained between sex, age, marital status, blood group and Rh factors with diabetes mellitus but not with residence and family histories. Male from sex, above 40 years from age, married from marital status were more susceptible for diabetes, contrary females, 16-40 years and singles were lower risk of diabetic than other comparable categories. In case of blood group, type A was more susceptible and blood type O and AB were lower risk rate of diabetes mellitus. Additionally blood AB/Rh negative individuals were not affected by type I diabetes mellitus.

Conclusion: The socio-demographic factor sex, age, and marital status showed a significant association but family history and residence did not show a significant association with DM. In blood groups, the other important point that observed was, no one founds who had AB blood groups that diagnose type one DM. The majority of the study participants had Rh-positive, though the significant difference between diabetic and non-diabetic was observed only in Rh negatives.

Keywords: Association, Blood group, Diabetes mellitus, Rhesus factor, Socio-demographic factors

INTRODUCTION

Diabetes is a multi-factorial trait that is complex and appears to involve interactions of genetic, immunological, and environmental factors. It has a genetic predisposition, although environmental factors do play their role in its genetic expression.[1] At present, diabetes mellitus (DM) is recognized as a global major public health problem that contributes to ill health, premature mortality and morbidity in the worldwide. Nowadays, there are three commonly known types of diabetes. These are type 1 type 2 and gestational diabetes. Mostly all this type of diabetes can coexist with hypertension and obesity at high frequency.[2] Scientists suggest that people suffering from DM were increasing due to socio-demographic factors or genetic changes, socio-demographic factor which may have a contribution for DM include population growth,

aging, urbanization, low physical activity, and the high prevalence of obesity.[3]

Additional to socio-demographic factors, over the past years in the 19th century, researchers have found out the relationship between particular blood groups and increased susceptibility to inherited traits and many hereditary diseases[4] including diabetes and cancer. The major human blood group system is ABO based on A and B antigen, and also depends on the presence or absence of Rhesus (Rh) antigens, blood group classified into Rh positive or negative.[5] This system is one of such genetic make-up of an individual that will provide much valuable information for each person.[6] However, the association between the distribution of the ABO blood types and diseases is conflicting because no diseases are known to result from the lack of expression of ABO blood group antigens.[7] This study signifies to determine associations of DM with socio-demographic factors (sex, age, marital status, residence, and family history), blood group (A, B, AB, and O), and Rh factors (positive and negative).

MATERIALS AND METHODS

Study area

The study was conducted at Dangila first-level hospital. Dangila is one of the administration towns in Awi Zone of Northwestern Ethiopia [Figure 1] which is found about 485 km northwest of Addis Ababa and 78 km southeast of Bahir Dar city. Dangila town was bordered on the South by Faggeta Lekoma, on the Southwest by Guangua, on the Northwest by the Jawi, and on the Northeast by the West Gojjam Zone. Dangila town administration situated an altitude of 2200 m above sea level with latitude and longitude of 11°16′N and 36°5′E, respectively.[8] In Dangila town administration, there is only one governmental first-level hospital and one health center. The hospital started services to urban, rural, and the neighboring woreda residents since 2015.

Study population and design

This study was conducted in case–control/random sampling ways in Dangila primary hospital. The selected samples were a total of 201 diabetic patients attending for medical follow-up and 202 other healthy subjects population used as a controlled unit. The controlled unit sample used to determine the distribution of ABO blood groups in the population. All the study subjects participated at any age in both sexes.

Sample size determination

The representative samples were selected using a random sampling technique from individuals who address to give socio-demographic information and blood samples for the diagnosis of blood types. For estimating the sample size (N), the researcher used statistical formula at 5% level of significance and since the prevalence of diabetes diagnosis
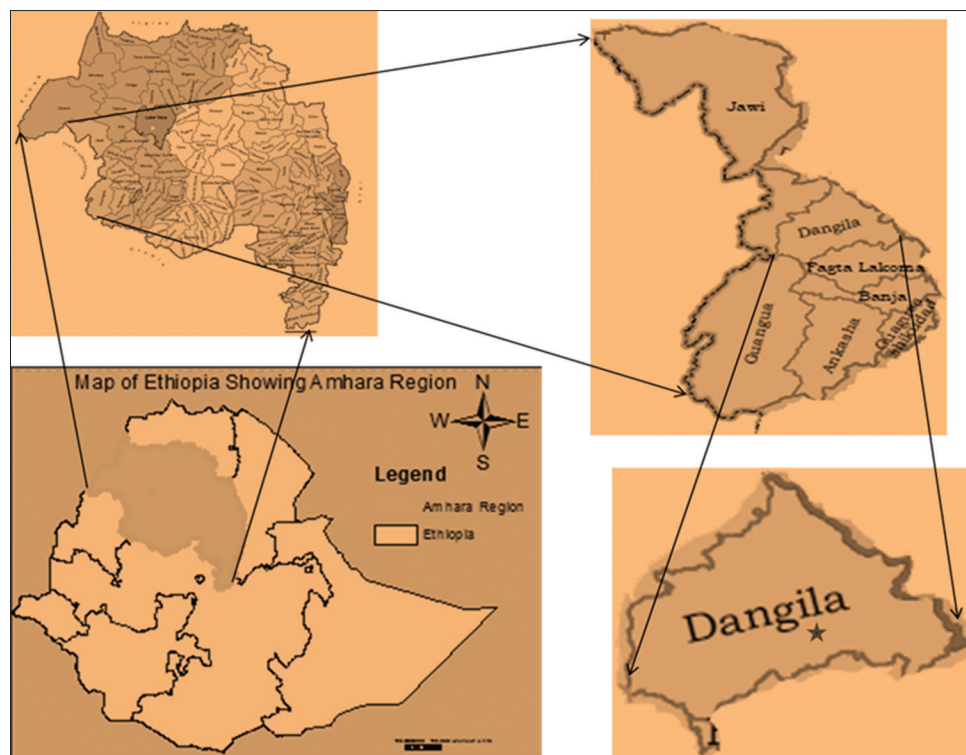

Figure 1: Map of the study area (source; FDRE CSA, 2007).

with specific blood group and socio-demographic factors was not known in the study area, due to this *P* value was taken to be 50% for the calculation.[9]

RESULTS

Socio-demographic variables and DM

In this study, a total of 403 study subjects were participated, from those 202 were non-diabetics and 201 were diabetics patients. Of the participants, 225 were males and 178 were females. The majority of males were under diabetic categories and females were from non-diabetics categories. Sex had significant frequency association with DM. The age of study participants had three categories, 1–15 years old, 16–40 years old, and above 40 years old. Most of the participants were in 16–40 years old followed by above 40 years old. Most of the diabetics were above 40 years old whereas non-diabetics were in 16–40 years old.

Association between sex and DM

Total study subjects, 225 (55.8%) were males and 178 (44.2%) were females. Healthy subjects were 202, of which 92 (45.5%) were males and 110 (54.5%) were females. Out of 201 diabetic patients, 133 (66.2%) were males (58 T1DM and 75 T2DM) and 68 (33.8%) (23 T1DM and 45 T2DM) were females [Table 1].

Association between age and DM

The other socio-demographic factor considered was the age of participants, the age between 16 and 40 had the highest frequency of 206 (51.11%) of all study participants, followed by above 40 years old which accounted for 119 (29.52%)

persons. The lowest frequency was recorded in 1–15 years old category which has 78 (19.35%) subjects [Table 2].

Most diabetic patients were found above the age of 40 years old (99), followed by 16–40 years old groups (68). However, most of the healthy subjects were found in age between 16 and 40 years (138) followed by 1–15 years old (202).

Association between marital status and DM

Marital status also divides both diabetics and non-diabetics into three groups, single, married, and divorced/widow [Table 3].

From all study participants, married groups (269) had the highest frequencies. In contrast to this group, the lowest frequency was obtained in divorced/widowed categories with 10 participants. Most of the diabetic populations also were married (150) followed by single (45) individuals.

Association between residence and DM

In regard to diabetes prevalence on the residence, most of the diabetics (124) lived in urban areas, whereas the remaining 77 diabetics lived in rural areas. From urban diabetic patients, 28 individuals were type one diabetics and 96 were type two diabetics. In rural areas, there were also 53 type one and 24 type two diabetics [Figure 2].
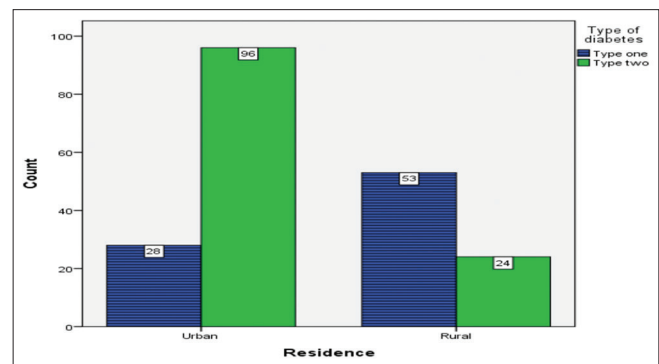
Association between family history and DM

The other independent variable considered was family history of all sampled individuals. In this variable, only eight individuals had diabetic family members; the other 395 peoples have no diabetic family members [Table 4].

Association between blood groups and DM

Association between ABO blood groups and DM

Each type of blood group has different frequencies in the sampled population both in diabetic and non-diabetic groups [Table 5].

Table 1: Association between sex of diabetics and non-diabetics.

Sex	Non-diabetics	Diabetics	Total	*P*-value
Male	92	133	225	0.006
Female	110	68	178	0.002
Total	202	201	403	

Table 2: Association between age and diabetes mellitus.

Age	Diabetics		Non-diabetic	Total	*P*-value
	Type one	Type two			
1–15 years old	27	7	44	78	0.258
16–40 years old	44	24	138	206	0.00
Above 40 years old	10	89	20	119	0.00

Figure 2: Frequency of diabetes mellitus in rural and urban areas.

The frequency of ABO blood groups in non-diabetics population from largest to smallest was 86, 61, 39, and 16 for O, A, B, and AB blood groups, respectively, and 89, 81, 46, and 11 for A, O, B, and AB in diabetic patients, respectively.

From the entire population, blood A group had the highest frequency (150) followed by blood O group (141). Blood A group counted 61 individuals of nondiabetics and other 89 of diabetics. Blood O group accounted for 86 nondiabetics and 55 of diabetics. The third frequent type of blood group

Table 3: Association between marital status and diabetes mellitus.

Marital status	Diabetics		Non-diabetic	Total	P-value
	Type one	Type two			
Single	42	3	79	124	0.002
Married	39	111	119	269	0.059
Divorced/widowed	0	6	4	10	0.527

Table 4: Association between family histories and diabetes mellitus.

Family members	Diabetics	Non-diabetics	Total
Have diabetic family members	5	3	8
Have no diabetic family members	198	197	395
Total	201	202	403

Table 5: Association between blood ABO group and diabetes mellitus.

	Diabetics		Non-diabetic	Total	P-value
	Type one	Type two			
A	39	50	61	150	0.022
B	16	30	39	85	0.44
AB	0	11	16	27	0.34
O	26	29	86	141	0.009

Table 6: Association between Rh factor and diabetes mellitus of participants.

Rh factors	Diabetics		Non-diabetics	Total	P-value
	Type one	Type two			
Rh-positive	81	113	184	378	0.607
Rh-negative	0	7	18	25	0.028
Total	81	120	202	403	

Rh: Rhesus

was B; 85 individuals had blood B group from all study subjects. In this blood group, there were 39 nondiabetes and 46 of diabetic patients. The fourth AB blood group had the least frequency in all study subjects. In this blood group, there were 11 persons from diabetic and 16 individuals from healthy subjects. In this blood group, there were no an individual's who diagnosed type one diabetic types; all 11 individuals had type two diabetic types.

Association between Rh factors and DM

Rh factor was the second clinical variable which might affect the frequency of DM. From all sampled populations, 378 of them were Rh-positive. The remaining 25 of them were Rh-negative [Table 6].

In diabetic patients, all of type one diabetic was Rh-positive, no one who had negative Rh factors. The other 120 type two diabetic's individuals had positive or negative Rh factors. Under Rh-positive categories, one 113 (70 male and 43 females) were recorded. In Rh-negative only seven (five males and two females) individuals were found. On non-diabetic individuals, 184 (83 males and 101 females) were Rh-positive, the other 18 (nine males and nine females) were Rh-negative.

DISCUSSION

Of the socio-demographic factors considered in this study, sex, age, and marital status showed a significant association, whereas residence and family history did not show a significant association with DM. The prevalence of DM was higher in males than females, with a significant frequency difference between diabetics and non-diabetic groups. Other study conducted also result in the same outcomes on the prevalence of T2DM was 19.3% for men and 15.3% for women in adult's ≥50 years.[10] Another study was obtained in the Middle East and developing societies, which stated that females were more affected in Iran and Middle East countries than males.[11]

A significant frequency difference was observed on the prevalence of DM in the 16–40 years and oldest category (above 40 years old) group. This result supported that the prevalence of DM increases with age.[12] Additional findings also showed that diabetic patients were more likely to be above 40 years old.[13] In this variable of age with diabetes, no literature exist which contradicts the outcome of this study. Marital status had significant associations with diabetes; the report showed that married and retired people had better practice toward diabetes.[14] In other study in a different way to this result.[15] stated no significant difference observed in the prevalence of DM and PDM, between the married and other subgroups.

The prevalence of the disease both in urban and rural areas was equal. However, the distribution of T1DM and T2DM in the study shows residence variations. T1DM was more dominant in rural parts whereas T2DM was more common in the town. Some studies agreed with these results that conducted in Poland stated that no significant difference was found between residents of urban and rural areas in the quality of diabetes care.[16] Similarly, the study conducted at University of Gondar referral hospital stated that there were more type 1 DM patients in rural areas compared to urban residents and much more type 2 DM patients were from urban areas compared to rural areas.[17] This result contradicts with a study that very high levels of diabetes have been reported in urban areas of India, but few data are available for rural regions where most of the population.[18]

Family history of the population had no significant association with DM. This contradicts with other similar studies such as a study conducted in the US that adults with two diabetic parents had more than twice the risk of diabetes than adults with only one diabetic parent.[19] The rate of awareness of diabetes risk factors in the participants with a family history of the disease exceeded than other observed group[20] and also family history of diabetes was associated with type 2 diabetes (T2DM).[21]

Association between ABO blood groups and DM

Blood O group was the most frequent blood group in non-diabetic subjects, but A blood group was more frequent in the case of diabetic peoples with a significant difference but B and AB blood groups were the third and fourth frequent blood groups both in diabetics and non-diabetic population without significant frequency difference.

Other studies which support this conclude that the frequency of ABO blood groups among type 2 diabetics and concluded that type 2 diabetes and blood groups are interrelated because of the broad genetic immunologic basis. According to them, the frequency of blood groups B and O is significantly higher and lower, respectively, in type 2 diabetics when compared to the general population.[6] The result contradicts to the this research on the higher risk of blood groups but they agreed on the lower risk of O blood groups. The other research which also partially accepts and contradicts this study stated that AB blood group was significantly more frequent in type-1 DM and A blood group is more frequent in type-2 DM.[22] Other research which contradicted with the result of this study also resulted the prevalent of DM in O blood groups were more frequent than others without statistical frequency difference.[7] This study did not agree with this research on the prevalence of blood group. The other study conducted in Namakkal town also contradicts this study and stated that there was a significant difference between diabetic patients and healthy individuals only in blood group B ($P <$ 0.05).[23] The other study which contradicts to this research again in ABO blood group comes from Koley[24] stated that there was no significant difference in ABO blood groups in diabetics and healthy subjects.

O and A blood groups, Rh negatives groups were more frequent in nondiabetics with significant frequency difference than diabetics, but Rh positives had greater number of frequency in diabetic than non-diabetics without significant frequency difference. The research proceeds by Al-Ali in 259 of diabetics (95 males and 164 females) agreed with this study on the frequency of Rh factors, and stated that the frequency of diabetes in Rh-negative blood group was 8.54% and in Rh-positive as 91.45%.[25] Munaza *et al*. also resulted that the prevalent of DM in Rh+ blood groups was more frequent than others without a statistical test of difference.[7] The study accepts Rh factor frequency of this study with the test of statistical difference. The other research which contradicts this study stated that Rh negativity was significantly more often in diabetics than controls in our population.[22] Kumar and Sharmila similar study conducted in Namakkal town, which contradicts to this study and stated that there was a significant frequency difference in Rh-positive among diabetic and controlled groups ($P < 0.05$).[23]

CONCLUSION

The socio-demographic factor sex, age, and marital status showed a significant association but family history and residence did not show a significant association with DM. The majority of diabetic affected individuals were males with ages above 40 years old. Specifically, type one DM was more frequent in the age group between 16 and 40 years old, though most non-DM also founds in this category. The majority of type two DM occur after the age of forty. In marital status, single groups had a lower risk fate of diabetes than married and widowed (divorced). Individuals with blood type A were at a higher risk of DM than others, in contrary individuals with AB and O blood group had a lower risk of DM than others but in B and AB blood groups, significant difference could not observe between diabetic and control groups. In blood groups, the other important point that observed was, no one founds who had AB blood groups that diagnose type one DM. The majority of the study participants had Rh-positive, though the significant difference between diabetic and non-diabetic was observed only in Rh negatives. None of type one DM participates in this study which had Rh-negative.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms.

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Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. World Health Organization. The Prevention of Diabetes and its Complications. World Health Organization; 2006. Available from: http://www.who.int/diabetes. [Last accessed on 2019 Nov 30].
2. Yusuf S, Hawken S, Ounpuu S, Dans T, Avezum A, Lanas F, *et al.* Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): Case-control study. Lancet 2004;364:937-52.
3. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: Estimates for the year 2000 and projections for 2030. Diabetes Care 2004;27:1047-53.
4. He M, Wolpin B, Rexrode K, Manson JE, Rimm E, Hu FB, *et al.* ABO blood group and risk of coronary heart disease in two prospective cohort studies. Arterioscler Thromb Vasc Biol 2012;32:2314-20.
5. Alhowaish AK. Economic costs of diabetes in Saudi Arabia. J Family Community Med 2013;20:1-7.
6. Qureshi MA, Bhatti R. Frequency of ABO blood groups among the diabetes mellitus Type 2 patients. J Coll Physicians Surg Pak 2003;13:453-5.
7. Munaza J, Muhammad A, Shakeel M. Frequency of ABO and Rh blood groups in patients with diabetes mellitus. Pak J Med Health Sci 2017;11:114.
8. Taye F. Determinant of Contraceptive use, the Cause of Suburb Kebeles of Dangila Town. Msc Thesis. Ethiopia: Bahir Dar University; 2015.
9. Naing L, Winn T, Rusil B. Practical issues in calculating sample size for prevalence studies. Arch fac Sci 2006;1:9-14.
10. Shukang W, Wei M, Zhongshang Y, Shu-Mei Y, Hongying J, Fuzhong X. Association between obesity indices and Type 2 diabetes mellitus among middle-aged and elderly people in Jinan, China. BMJ 2016;10:1-9.
11. Gupta A, Gupta R, Sarna M, Rastogi S, Gupta VP, Kothari K. Prevalence of diabetes, impaired fasting glucose and insulin resistance syndrome in an urban Indian population. Diabetes Res Clin Pract 2003;61:69-76.
12. Azimi-Nezhad M, Ghayour-Mobarhan M, Parizadeh MR, Safarian M, Esmaeili H, Parizadeh SM, *et al.* Prevalence of Type 2 diabetes mellitus in Iran and its relationship with gender, urbanisation, education, marital status and occupation.
13. Murad MA, Abdulmageed SS, Iftikhar R, Sagga BK. Assessment of the common risk factors associated with Type 2 diabetes mellitus in Jeddah. Int J Endocrinol 2014;2014:616145.
14. Al-Naggar RA, Osman MT, Ismail N, Ismail Z, Noor AN, Ibrahim NS. Diabetes mellitus among selected Malaysian population. Int J Med Res Health Sci 2017;6:1-11.
15. Rahmanian K, Shojaei M, Jahromi AS. Relation of Type 2 diabetes mellitus with gender, education, and marital status in an Iranian urban population. Rep Biochem Mol Biol 2013;1:64-8.
16. Dudzińska M, Tarach JS, Zwolak A, Kurowska M, Malicka J, Smoleń A, *et al.* Type 2 diabetes mellitus in relation to place of residence: Evaluation of selected aspects of socio-demographic status, course of diabetes and quality of life a cross-sectional study. Ann Agric Environ Med 2013;20:869-74.
17. Lester FT. Childhood diabetes mellitus in Ethiopians. Diabet Med 1986;3:278-80.
18. Ramachandran A, Snehalatha C, Kapur A, Vijay V, Mohan V, Das AK, *et al.* High prevalence of diabetes and impaired glucose tolerance in India: National urban diabetes survey. Diabetologia 2001;44:1094-101.
19. Meigs JB, Cupples LA, Wilson PW. Parental transmission of Type 2 diabetes: The Framingham offspring study. Diabetes 2000;49:2201-7.
20. Pierce M, Harding D, Ridout D, Keen H, Bradley C. Risk and prevention of Type II diabetes: Offspring's views. Br J Gen Pract 2001;51:194-9.
21. Zhao Y, Song C, Ma X, Ma X, Wang Q, Ji H, *et al.* Synergistic effect of family history of diabetes and dietary habits on the risk of Type 2 diabetes in central China. Int J Endocrinol 2017;2017:9707284.
22. Oner C, Dogan B, Telatar B, Celik Yagan CF, Oguz A. Frequency of ABO/rhesus blood groups in patients with diabetes mellitus. J Coll Physicians Surg Pak 2016;26:74-5.
23. Kumar G, Sharmila B. Relationship between ABO, Rh blood groups and diabetes mellitus, obesity in Namakkal town. Int J Adv Pharm 2014;3:996-8.
24. Koley S. The distribution of the ABO blood types in patients with diabetes mellitus. Anthropologist 2008;10:129-32.
25. Al-Ali H. Association of ABO and Rh blood groups with diabetes mellitus and hypertension in Basrah city. Basrah J Sci 2008;26:29-32.

Singapore Med J 2008;49:571-6.