ORIGINAL ARTICLE

TYPE II DIABETES MELLITUS IN JIMMA TOWN, SOUTHWEST ETHIOPIA

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ABSTRACT

BACKGROUND: *Diabetes mellitus is a common metabolic disorder resulting from defects in insulin action, production, or both. Type II diabetes is the most common form accounting for 90-95% of all diabetes cases worldwide. The prevalence of diabetes mellitus is not documented in Ethiopia in general and in the study area in particular. This study was conducted to determine the prevalence of type II diabetes, impaired glucose tolerance and impaired fasting glucose in Jimma Town, south west Ethiopia.*

METHODS: *This cross-sectional study was conducted in Jimma Town from December 1-June 30/2006. Sample size was determined using formula for estimating single population proportion. Three 'Kebele's were selected by cluster sampling method and study households were identified by systematic sampling technique from each 'Kebele'. Participants with fasting venous plasma glucose concentrations less than 100 mg/dl were classified as "normal, "Diabetes was diagnosed when fasting blood glucose level become 126mg/dl and above. An oral glucose tolerance test was performed for subjects whose fasting blood glucose level was between 100-126mg/dl. The data were entered into a computer and analyzed using SPSS for windows version 12.0.1. Statistical tests for significance were performed at the level of significance of 5%.*

RESULTS: *The blood glucose level of 28 out of 526 participants was in diabetic range making the prevalence of Type II diabetes to be 5.3% and 81 (15.4%) had elevated blood glucose level (100-126 mg/dl). After oral glucose tolerance test was performed for those with elevated blood glucose level, 3 (0.57%) had diabetes, 37 (7%) impaired glucose tolerance test and 41 (7.8%) impaired fasting blood glucose. The combined prevalence of impaired fasting glucose and glucose tolerance test was 14.8%. There was a statistically significant association between diabetes mellitus and male sex, older age group and being overweight ($p<0.05$). The prevalence of diabetes mellitus, impaired glucose tolerance test and impaired fasting glucose were higher among older age groups, those with higher monthly income, overweight/obese, and in males.*

CONCLUSION: *Our study showed that the magnitude of Type II diabetes was comparable to reports from other developing countries however, large proportion of the study participants had pre-diabetic conditions. Type II diabetes was associated with being overweight, male sex, older age group and with higher household monthly income.*

Behavioral change communication on the need for healthy life styles including regular exercise, having diversified diet and the need for getting regular screening for diabetes is recommended to prevent and early detect Type II diabetes in the study community. Large-scale study involving the rural areas is recommended to determine the burden.

KEY WORDS: *Type II diabetes, oral glucose tolerance test, Southwest Ethiopia*

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INTRODUCTION

Diabetes mellitus (DM), a common metabolic disorder resulting from defects in insulin action, production, or both and it is classified as Type I, Type II, gestational diabetes and other (1). In type II diabetes the β-cells in the pancreas are destroyed leading to a deficiency in insulin production and the disease develops over the course of a few days or weeks. Over 95% of people with type II diabetes are diagnosed before the age of 25 years (1-2). Type II diabetes is characterized by insulin resistance and/or decreased insulin secretion (3-4). It is the most common form of DM, accounting for 90-95% of all diabetes cases worldwide. Impaired glucose tolerance (IGT) and impaired fasting glucose (IFG) are the other pre-diabetic conditions associated with insulin resistance.

In IGT and IFG, the blood glucose concentration is above the normal range, but below levels required for the diagnosis of diabetes (2). Subjects with IGT and/or IFG are at substantially higher risk of developing diabetes and cardiovascular disease than those with normal glucose tolerance (2,5-6). The conversion of individual with IGT and IFG to type II diabetes varies with ethnicity; anthropometric measurements related to obesity, fasting blood glucose and the two-hour post glucose load level (2). The other important risk factor is hyperinsulinemia-higher than normal levels of fasting insulin (1, 7). Environmental factors like obesity, lack of exercise and sedentary lifestyle sometimes lead to insulin resistance, which means that body cell do not respond appropriately though insulin is present (8). Though type II diabetes is a more complex problem than type I, if is easier to treat especially in the initial years when insulin is often still produced. It may go unnoticed for years in patients before diagnosis, since the symptoms are typically milder (no keto-acidosis) and can be sporadic. Severe complications that include renal failure, blindness, coronary artery disease and hypertension can result from unnoticed type II diabetes (9-11). Based on the large number of people with undiagnosed diabetes and the high prevalence of complications at diagnosis, it seems pragmatic that earlier diagnosis and treatment would reduce the burden of diabetes and its complications.

The prevalence of type II diabetes varies widely between population, reflecting differences in both environment influences and genetic susceptibility. A number of risk factors are attributed to the incidence of diabetes, including family history, age, and social group characteristics, behavioral, lifestyle, physiological and clinical factors (1,12). According to WHO, the prevalence of diabetes mellitus is increasing in developing countries due to population growth, aging, unhealthy diets, obesity and sedentary lifestyles (13). In the developed countries the prevalence of both diabetes and impaired glucose tolerance are higher (14-16), reaching up to 16% (17-18).

To the best of the authors knowledge, there are no population based studies conducted in Ethiopia in general and in the study area in particular. Hospital based studies showed that the prevalence of diabetes has increased from 1.9% in 1970 to 9.5% in 1999 (19-23). WHO estimated the number of diabetic cases in Ethiopia to be 800,000 by the year 2000, and the number is expected to increase to 1.8 million by 2030 (24). However, due to the widening of social differences in economic status, circumstantial evidences show that the urban population is facing higher level of overweight and obesity.

Therefore, this study was conducted to determine the prevalence of type II diabetes mellitus as well as glucose intolerance and associated socio-demographic factors in Jimma Town, Southwest Ethiopia. The results will serve for designing behavioral change communication to prevent the burden of diabetes in the study community.

SUBJECTS AND METHODS

This study was carried out in Jimma Town, which is found 346 kilometers Southwest of Addis Ababa. The Town has an estimated population of 151,527 projected from 1994 population and housing census. From Central Statistics Agency (36) report, adult population 40 years and above constitutes 12.5% of the urban population of Oromia region. Taking this in to account the Jimma Town adult population was estimated to be 18,941. A cross-sectional study was carried out among adults 40 years and above in Jimma Town from December1- June 30, 2006 to determine the prevalence of type II diabetes mellitus. Sample size was calculated using formula for estimating single population proportion employing expected prevalence of diabetes to be 50% as there was no prior study on the subject in the study area, at 95% confidence level and 5% margin of error giving 384. A design effect of 1.5 was used for the cluster sampling to give a final sample size of 576. One kebele was randomly selected from each of the three 'Kefitegna's of the town. The total sample size 576 was distributed to the three 'kebele's employing proportional to size allocation to the kebeles. A systematic sampling technique was used to identify the study households from each 'Kebele'. In cases where there were more than one eligible individual in the selected household, a lottery method was used to pick one and in the event that there was no eligible person in the selected household, the next door was visited. Data were collected by 12 grade complete interviewers who had been involved in the longitudinal study data collection using a pre-tested structured Amharic version questionnaire. The data collectors were given a three day training on the interview techniques and on the questionnaire before data collection.

Data on socio-demographic variables, weight, height, family history of diabetes, current drug history, which affects glucose tolerance, were collected. Smoking and strenuous exercise were not allowed before the sample collection. A comfortable waiting area was provided for the duration of the blood sample collection. Two milliliter of venous blood samples were drawn from each subject in the morning after 10 – 12 hours (over night fast) with only drinking water allowed and sent to

the laboratory in fluoride oxalate containers in an icebox. Plasma glucose level was determined by the enzymatic method glucose oxidase. For oral glucose tolerance test (OGTT) a glucose load equivalent to 75g anhydrous glucose was given in a total water volume of 250ml. the glucose solution was kept at room temperature (20-25^{0}C). The glucose drink was consumed over 5min. Timing for the test started at the beginning of ingestion. The test was invalid if the person vomited. A further blood sample was collected 2 hours after the glucose load and the glucose concentration measured.

Diagnostic criteria for epidemiological studies on diabetes and other categories of hyperglycemia were used as recommended by the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus (2, 11). Accordingly, individuals with fasting venous plasma glucose concentration of <100mg/dl were classified as normal. An OGTT was not performed for this group. When the fasting venous plasma glucose concentration was ≥126mg/dl, the test was repeated on another day. Cases were classified as diabetic when they were found to have a fasting blood glucose level of ≥126mg/dl on the second test. An OGTT was performed in subjects with fasting plasma glucose levels ≥100 and <126mg/dl. The diagnosis of diabetes was considered when the two-hour post glucose load venous plasma glucose level was ≥200mg/dl. A diagnosis of IGT was made when venous plasma glucose concentration was ≥140 and <200 mg/dl. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared. For adults chronic energy deficiency was defined as BMI <18.5 kg/m^2, normal weight between 18.5-25kg/m^2, overweight ≥26kg/m^2 and obesity was defined as ≥30kg/m^2 (9).

The study proposal was approved by Jimma University Ethical review committee and permission was obtained from each "kebele" administrations. The participants were informed about the purpose of the study and verbal consent was obtained before each interview and blood sample collection. At the end of the study, the diabetic subjects were sent to the Department of internal medicine for follow-up and treatment.

Data were entered in to a computer and analyzed using SPSS for windows version 12.0.1. Statistical tests for significance were performed where appropriate at the level of significance of 5%.

RESULTS

Out of 576 study participants planned, 526 were enrolled giving a response rate of 91.3%. From the 526 subjects who participated in the study 120 were males (22.8%) and 406 females (77.2%) giving a sex ratio of 0.3:1. The majority, 272 (51.7%) were illiterate, 296 (56.3%) housewives, 332(63.1%) Orthodox Christian, 314 (59.8%) had the lowest income and 283(53.6%) had BMI ≥26 kg/m^2 (Table 1).

Overall, 106 (20.2%) of the study participants had abnormally elevated blood sugar level (Fig.1), of whom 25 (4.8 %) were diabetic and 81(15.4%) had high blood glucose level but do not define diabetes. After OGTT was performed for the second group, 3 (0.57%) became diabetic, 37 (7%) had IGT and 41(7.8 %) had IFG. The combined prevalence of IFG and IGT was 78 (14.8 %). After OGTT, the total number of diabetic subjects became 28 giving the prevalence of 5.3% (Fig. 2).

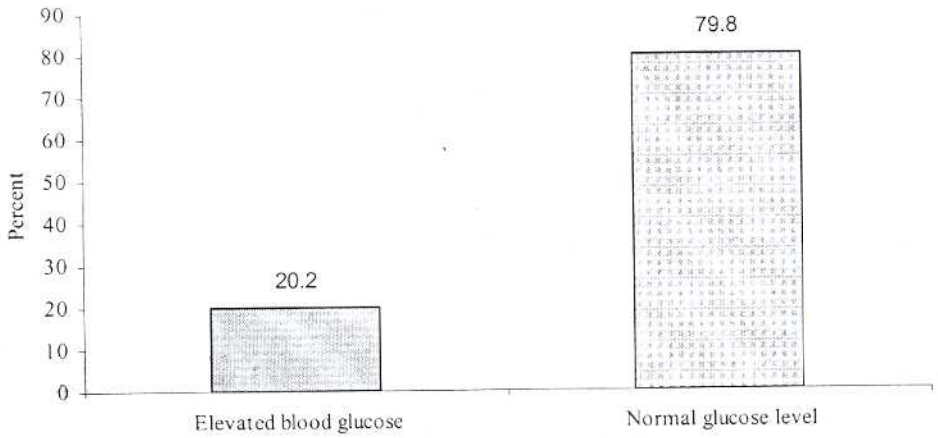

Figure 1. Prevalence of hyperglycemia among adult population in Jimma Town, Southwest Ethiopia, December 2006

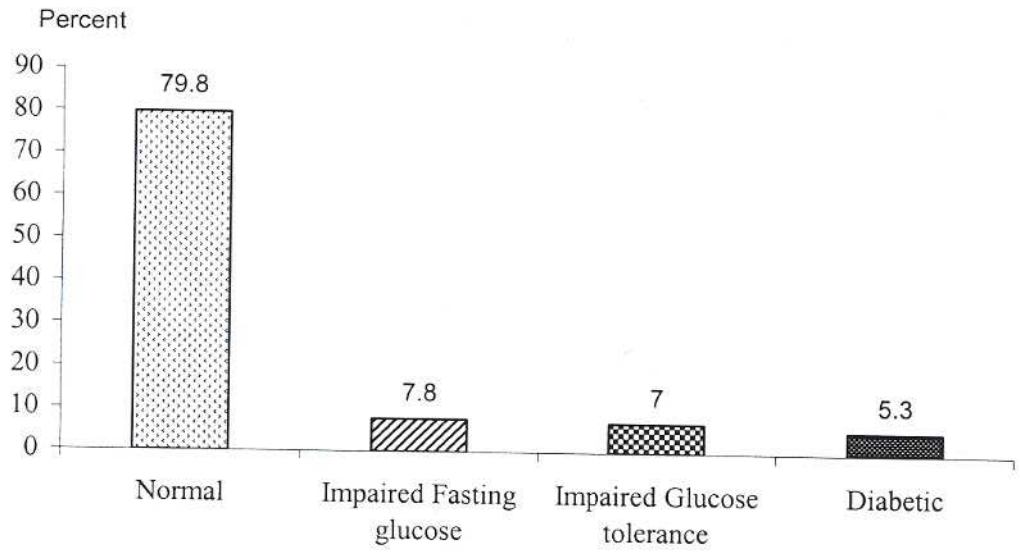

Figure 2. Prevalence of diabetus and impaired glucose regulation(IFG & IGT) among adult population in Jimma Town, Southwest Ethiopia, December 2006.

It was observed that the prevalence of diabetes mellitus, impaired glucose tolerance and impaired fasting glucose were higher among older age groups, subjects with higher monthly income, male subjects and those who were overweight. Type II diabetes was significantly associated with age, income, sex and nutritional status as determined by body mass index (P< 0.05) (Tables 1&2).

Table 2. Percentage distribution of diabetes, IGT, and IFG prevalence by Socio- demographic characteristics in Jimma town southwest Ethiopia, Dec. 2006

Variables	Normal	Diabetic	IGT	IFG	N= 526	P-value
Age						
40-50	81.9	3.07	8.87	6.5	293	
51-60	87.8	4.3	3.5	4.3	115	<0.05
>60	66.9	11.9	5.9	15.3	118	
Sex						
Male	73.8	9.1	10	5	120	<0.05
Female	81	4.2	6.2	8.6	406	
Educational status						
Illiterate	82	3.7	5.6	8.5	270	
Read & write	78.9	6.1	7	8	213	
Secondary	65	13	17	4.3	23	>0.05
Post secondary	75	10	15	0	20	
Occupation						
Merchant	72.2	3.8	11.4	12.6	79	
House wife	83.1	1.4	4.7	8.1	296	
Gov. Employee	70.2	12.8	14.9	2.1	47	>0.05
*Other	80.6	6.8	6.8	5.8	103	
BMI						
Normal	82.8	3.7	6.5	7	431	
Over weight	62.8	15.9	10	11.6	70	<0.01
Obese	76	4	8	12	25	
Family history of DM						
Yes	77	13.6	4.5	4.5	22	
No	79	5	7.1	7.9	504	<0.05

* Daily laborer, housemaids

Table 1. Diabetes mellitus cases by socio-demographic, anthropometric variables, Jimma town Southwest Ethiopia, December 2006

Socio-demographic variables(n=526)	Type II Diabetes		P value
	Yes	No	
	No. (%)	No. (%)	
Age			
40-50	9(3.1)	284(96.9)	0.04
51-60	5(8.1)	57(91.9)	
≥60	14(8.2)	157(91.8)	
Sex			
Male	11(9.2)	109(90.8)	0.03
Female	17(4.2)	389(95.8)	
Religion			
Orthodox Christian	19(5.7)	313(94.0)	
Muslim	9(5.1)	169(94.9)	
Protestant	0(0.0)	7(100.0)	0.81
Others‡	0(0.0)	8(0.0)	
Educational status			
Illiterate	10(3.7)	260(96.3)	0.08
Primary (grade 1-8)	13(6.1)	200(93.9)	
Secondary and above (≥9)	5(11.6)	38(88.4)	
Occupation			
Merchant	3(3.7)	79(96.3)	0.07
House wife	12(4.1)	284(95.9)	
Gov. Employee	6(12.8)	41(87.2)	
Other ʃ	7(7.0)	93(93.0)	
Monthly income			
≤200 Birr	11(3.5)	303(96.5)	
200-1000 Birr	8(11.1)	64(88.9)	0.02
>1000 Birr	2(9.1)	20(90.9)	
Family history			
Yes	3(13,6)	19(86.4)	0.76
No	25(5.0)	479(95.0)	
BMI			
<18.5	3(2.1)	140(97.9)	0.01
18.5-25	12(12.6)	83(87.4)	
≥26	12(4.3)	270(95.7)	

‡ Catholic, Jehovah, ʃDaily laborer, driver, pensioner

DISCUSSION

Uncontrolled hyperglycemia over time damages the eye, nerves, blood vessel, kidneys and heart, causes organ dysfunction and failure (8, 19). While close monitoring of glucose level delays many of the complications in patients with diabetes (2) about half of diabetic individuals are often asymptomatic for many years (8). The current study showed that out of the total subjects involved in the study, 20.2% subjects have abnormally elevated blood sugar; and only 5.3% have clinically overt diabetes.

WHO estimated the number of diabetic cases in Ethiopia to be 800,000 by the year 2000, and the number is expected to increase to 1.8 million by 2030 (23). Though there has not been a population-based estimate of the prevalence of type II diabetes in Ethiopia, the prevalence of the disease found in this study is comparable to the findings of other community-based studies in developing countries (7, 25, 26, 27, 32). The prevalence was reported to be 5.5% in northern part of Sudan (26), and 3.8% in Cameroon (27). Another study conducted in Port Harcourt, Nigeria showed the crude and standardized prevalence to be 6.8 and 7.9%, respectively (7, 25).

The prevalence of type II diabetes varied widely among various racial and ethnic groups, reflecting differences in both environmental influences and genetic susceptibility (9, 25, 28). Closely related to the widening of social differentials in economic status, evidences show that the urban population is facing an increased level of overweight and obesity (7). Similarly, this study showed that Type II diabetes mellitus is significantly associated ($P<0.05$) with age, gender and monthly income of the household of the study participants.

Risk factors for type II diabetes include family history, advanced age, physical inactivity, ethnicity and history of gestational diabetes. Genetics and environmental factors are the main contributors to type-2 diabetes. Physical inactivity, weight gain and obesity are also risk factors for the development of type II diabetes. Increased body fat and abdominal obesity are associated with insulin resistance (13,29).

The association of diabetes and sex has been the center of many studies (3,14,15,16, 30,33). Studies in developing countries have different reports with regard to the prevalence of diabetes by sex. Some studies showed that prevalence was higher in women (3,31,33) while others reported that diabetes was highly prevalent in men (14,15,30) and another study showed that the prevalence is similar in both sexes (16). In our study, we found a greater prevalence of diabetes and IGT in men, and the difference was statistically significant IFG was more prevalent in women. The women enrolled in this study were mainly housewives whereas men were working outside the home and household income is mostly controlled by men. These factors may have influenced the difference in the diabetes prevalence.

In many studies (3, 14, 31, 33,) it was reported that the prevalence of diabetes increased with age. Aging population is be expected to have higher prevalence of age-related diseases, such as type II diabetes. In our study, the prevalence of diabetes was significantly associated with age but the prediabetic conditions (IGT and IFG) were more prevalent in younger age between 40-50 years.

The other important risk factor is obesity, which is strongly linked to type II diabetes, and has been observed to have increased in many countries over recent decades (34). Indeed, the intimate relationship between diabetes and obesity has given rise to the term "diabesity" to characterize the close association of these two disorder (35). In our study also overweight and obesity were significantly associated with diabetes, IGT, and IFG (Tables 1 & 2).

In conclusion, the prevalence of type II diabetes was comparable to the reports of other developing countries. Though the prevalence of overt diabetes (5.3%) was lower compared to other developing countries large proportion (20.2%) the study participants had prediabetic conditions like IGT and IFG implying the need for regular check up of blood sugar levels in the age group 40 years and above in the study community. Types II diabetes was associated with being overweight, male sex, being in the older age group and being in the household with higher monthly income.

Behavior change communication on the need for healthy life styles including regular exercise, having diversified diet and the need for getting regularly screened for diabetes is recommended to early detect and prevent the occurrence of type II diabetes and its complications in the study community. Large-scale community based study involving the rural areas is recommended to determine the burden of type II diabetes mellitus.

ACKNOWLEDGEMENTS

The authors extend their appreciations to the research and publication office of Jimma University for funding the study. All study participants who volunteered to give their blood samples.

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