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Prevalence of Diabetes Mellitus in a Population-Based Sample of Adults in Tirana, Albania

Arjan Bregu[1*], Ervin Toçi[2], Llukan Rrumbullaku[3], Herion Muja[2], Enver Roshi[2] and Genc Burazeri[2,4]

[1]Ministry of Health, Tirana, Albania.
[2]Institute of Public Health, Tirana, Albania.
[3]Faculty of Medicine, University of Medicine, Tirana, Albania.
[4]Department of International Health, School for Public Health and Primary Care (CAPHRI), Faculty of Health, Medicine and Life Sciences, Maastricht University, Netherlands.

Authors' contributions

This work was carried out in collaboration between all authors. Authors AB, ET and GB contributed to the study conceptualization and design, analysis and interpretation of the data and writing of the article. Authors LR and ER contributed to the content and structure of the manuscript. Author HM contributed to the acquisition of the data and commented on the manuscript. All authors have read and approved the submitted manuscript.

Original Research Article

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ABSTRACT

Aims: Our aim was to assess the prevalence of diabetes mellitus through self-reports and measurement of fasting glucose level in a representative sample of Albanian adults residing in Tirana.
Study Design: Cross-sectional study.
Place and Duration of Study: The survey was conducted in urban Tirana during April-July 2012.
Methods: A population-based sample of 795 individuals aged ≥18 years was included in this study (60% women; overall mean age: 50.3±18.7 years; response rate: 79.5%). Finger stick method was used to measure fasting glucose level in all participants. Furthermore, weight and height were measured. Data on socio-demographic and socioeconomic factors were also collected. General linear model was used to assess the association of mean glucose level with demographic and socioeconomic characteristics and anthropometric indices.

**Corresponding author: Email: arjan.bregu@moh.gov.al;*

Results: The overall prevalence of self-reported diabetes was 11.8%. In multivariable-adjusted analysis, among non-diabetic individuals, age and body mass index were significantly and positively associated with mean fasting glucose levels. Conversely, among diabetic individuals, no statistically significant differences of mean glucose levels were observed upon multivariable-adjustment.
Conclusions: The prevalence of diabetes mellitus in this representative sample of primary health care users in Tirana was higher than previous reports from Albania. The management and control of diabetes is not adequate in the Albanian primary health care system, exposing individuals to a high risk for future diabetic complications.

Keywords: Albania; diabetes mellitus; management of diabetes.

1. INTRODUCTION

Diabetes mellitus (DM) prevalence is increasing in every society including developing countries [1] and half of people with diabetes are not aware that they suffer from type 2 diabetes [2], which comprises around 90% of all diabetes cases [3]. By 2025 the number of diabetes cases will be almost doubled in developing world compared to a 41% increase in developed countries [4,5]. DM is associated with increased mortality [6], cancer [7], artery coronary disease [8], renal failure [9], vision impairment [10], ulcer and lower extremities amputation risk [11]. Also, DM might foster disability through its complications which may impede the normal performance of everyday activities [12,13]. In economic terms, DM is a very costly disease as well [14,15].

It is obvious that DM poses major challenges to the health of affected human beings and it stresses the health systems of any nation to a great extent as the direct and indirect costs related to it swallow vast amounts of financial resources [1,16,17].

DM is an incurable chronic disease. Compared to other non-communicable conditions, DM control and management is heavily dependent on the level of patient engagement and cannot succeed without full patient compliance [18]. Evidence shows that DM patients spend 99% of their time managing their disease and only 1% is dedicated to consultations with health professionals [19]. Even though full DM management requires a multidisciplinary approach [20], single interventions such as the control of serum glucose level within the recommended thresholds might be beneficial as well. For example, a number of well-designed studies have demonstrated that the improvement of glycemic control leads to a reduction of cardiovascular complications [21].

Albania, a transitional country in the Western Balkans, is considered as one of the poorest countries in Europe. Traditionally, the Albanian population has employed a Mediterranean diet rich in fruit and vegetables, but the dietary patterns have substantially changed in the past two decades in line with the “modernization” of the society [22]. Whereas few studies and other sources have provided data about the prevalence of diabetes mellitus in Albania [22-26], the information about control and management of DM is scarce or, to our best knowledge, non-existent. There is a general agreement, notwithstanding the lack of proper documentation though, that the prevalence of both diabetes and obesity have increased in Albania in line with the rapid transition towards a market-oriented economy [22,26-29]. In this context, our aim was to assess the prevalence of diabetes mellitus through self-reports and measurement of fasting glucose level in a representative sample of urban adults residing in Tirana, the Albanian capital.

2. MATERIALS AND METHODS

2.1 Study Population

A cross-sectional survey was conducted in urban Tirana during April-July 2012. In Albania, there is universal health coverage regardless of the socioeconomic status of individuals. From this point of view, primary health care is equally accessible to all Albanian citizens. A population-based simple random sample of 1000 individuals aged ≥18 years was drawn based on the lists of inhabitants (sampling frame) available from the registries of family physicians working in primary health care centers of Tirana municipality, the capital of Albania. Of the initial 1000 individuals targeted for inclusion, 155 participants could not be interviewed due to the following reasons: they had moved away to another living address (n=33); they had moved permanently abroad (n=21); few had died (n=5); whereas 96 further individuals refused to participate in the survey. Of the remaining 845 individuals, 50 further individuals were excluded from the analysis due to incomplete data on basic demographic and socioeconomic factors and/or diabetes status. Therefore, this report is based on 795 individuals, with an overall response rate of 79.5% (795/1000).

2.2 Data Collection

Data on demographic and socioeconomic factors of the participating individuals were collected via face-to-face interviews using a structured questionnaire. The basic demographic and socioeconomic factors included gender, age, educational level and economic status. Information on age was categorized into three categories: *18-35 years*, *36-50 years* and *>50 years*, whereas information on educational attainment was categorized into: *low* (0-8 years of education); *middle* (9-12 years of education) and *high* (≥13 years of education). Also, respondents were asked to self-rate their economic status (categorized into: *low*, *middle* and *high*) based on the following question: "*According to your opinion, how would you rate your actual economic status?*"

Furthermore, participants were required to self-rate their general health status using a five-item Likert scale ranging from 1 to 5 where 1 stands for "very poor" and 5 stands for "very good". This variable was then recoded into three categories: *poor* (very poor + poor), *average* and *good* (good + very good).

In order to estimate the prevalence of diabetes, participants were asked the following question: "*Has a doctor ever told you that you have diabetes*?"

We also measured anthropometric indices including weight and height. Weight of the participants was recorded using calibrated scales and following the general rules of the survey protocol which suggested the removal of heavy clothing, shoes and any other heavy object the subject was carrying in the moment of the measurement. Height was also measured using a calibrated stadiometer and the participants were asked to remove their shoes and stand in the upright position. Based on these data, the Body Mass Index (BMI) was calculated. The later one was then recoded into a three category variable: *normal* (≤25.00), *overweight* (25.01-29.99) and *obese* (≥30.00).

Finger stick method, a rapid glucose test kit, was used to measure fasting glucose level in all participants. Individuals were instructed to come to the clinic early mornings before having breakfast or any other snack.

All individuals who agreed to participate gave their informed consent after being explained the aim and procedures of the survey.

2.3 Statistical Analyses

Absolute numbers and respective percentages were used to describe categorical variables. Mean values and their respective standard deviation were reported for numerical continuous variables. Chi-square test (for categorical variables) and student's t test (for continuous variables) were used to compare differences in diabetes prevalence between different demographic and socioeconomic groups of study participants.

General Linear Model (GLM) was used to estimate the associations of mean glucose level with demographic, socioeconomic and anthropometric indicators. Two models of GLM were used. The first model reported unadjusted or crude values of mean glucose level by independent variables. The second model adjusted for universal confounders such as sex, age, education level, economic status, BMI and self-reported health status. GLM was applied to both diabetic and non-diabetic subjects in order to visualize the values of glucose levels in these groups. Crude and multivariable-adjusted mean values and their respective 95%CIs of the fasting glucose levels according to different categories of the demographic and socioeconomic characteristics were calculated and presented.

In all cases a p-value of ≤0.05 was regarded as statistically significant. Statistical Package for Social Sciences (SPSS), version 15.0 was used for all the statistical analyses.

3. RESULTS AND DISCUSSION

Mean age of participants was 51.3±18.4 years for males and 49.7±18.8 years for females (P=0.219). The prevalence of self-reported diabetes in our sample was 11.8%. Table 1 presents in detail the distribution of diabetes status by demographic and socioeconomic factors, BMI and health status of study participants.

In unadjusted models, there were significant differences in mean fasting glucose levels by gender (borderline significant), age-group, education level, BMI and health status among non-diabetic persons whereas no significant differences were noticed among diabetic individuals (Table 2). In multivariable adjusted models, among non-diabetic individuals only age and BMI were significantly and positively associated with mean fasting glucose levels. For example, the mean glucose level among those aged 18-35 years old was 92 mg/dL compared to 102 mg/dL among those aged >50 years old (P<0.001). Also, mean fasting glucose level increased with the increase of BMI: among normal and obese persons the mean glucose level was 94 mg/dL and 99 mg/dL, respectively (P=0.027) (Table 2). The association with economic status had only borderline significance (P=0.092) and the mean fasting glucose level increased with the decrease of economic status.

Among diabetic persons, no statistically significant differences of mean glucose levels were observed by demographic and socio-economic variables in multivariable adjusted models. However, the trend suggested that mean fasting glucose level is higher among diabetic males, those aged 18-35 and >50 years old diabetics, those with middle educational level and it increases with the decrease of economic status and self-rated health status (Table 2).

Table 1. Demographic and socioeconomic characteristics of a representative sample of adults in Tirana, Albania, 2011

Variable	No diabetes (N=701)		Diabetes (N=94)	
	Number	Percentage*	Number	Percentage
Age (mean±SD) [A]	48.5 ± 18.5		63.8 ± 14.1	
Age-group [B]				
18-35 years	217	31.0	5	5.3
36-50 years	130	18.5	8	8.5
>50 years	354	50.5	81	86.2
Total	*701*	*88.2*	*94*	*11.8*
Gender [C]				
Male	280	39.9	41	43.6
Female	421	60.1	53	56.4
Education (mean±SD) [A]	13.0 ± 3.5		11.0 ± 4.2	
Educational level [B]				
Low	100	14.7	28	31.1
Middle	265	38.9	38	42.2
High	316	46.4	24	26.7
Economic status [B]				
Low	76	11.5	17	18.9
Middle	434	65.5	61	67.8
High	153	23.1	12	13.3
BMI [B]				
Normal	249	37.8	21	22.6
Overweight	284	43.2	41	44.1
Obese	125	19.0	31	33.3
Health status [B]				
Poor	33	5.0	18	20.0
Average	139	21.0	45	50.0
Good	489	74.0	27	30.0

** Absolute numbers in the sample and column percentages (in parentheses).*
[A] P<0.05 according to the t-test.
[B] P<0.05 according to the chi-square test.
[C] P>0.05 according to the chi-square test.

The present survey provided interesting information regarding the prevalence of diabetes in a sample of Tirana primary health care users aged 18 years and older and its distribution according to demographic and socioeconomic factors. In addition, for the first time it provided information about the management of diabetes through measurement of fasting glucose levels in population settings which, to our knowledge, has not been previously reported in Albania.

Our survey reported a relatively high prevalence of diabetes mellitus in this representative sample of Tirana adults compared to data provided by previous scientific research [22-26] which ranged from 6% among people aged 25 years and older [22] to 19% among elderly people aged 65 years or older [23]. Besides the fact that our definition of diabetes was based on self-reports, other factors may have contributed to such non congruent results between different studies including the increasing rates of overweight and obesity [27,28] and decreasing of physical activity [27,29], phenomena which have accompanied the Albanian transition since the fall of communism in early '90s.

Table 2. Association of the mean fasting glucose level with demographic and socioeconomic characteristics; unadjusted and multivariable-adjusted mean values from the general linear model

Variable	Unadjusted models		Multivariable adjusted models †	
	No diabetes	Diabetes	No diabetes	Diabetes
	Mean value (95%CI)-P*	Mean value (95%CI)-P	Mean value (95%CI) – P	Mean value (95%CI)-P
Gender				
Male	98 (96-101)-***0.061***	154 (134-172)-***0.424***	97 (94-100)-***0.248***	145 (106-184)-***0.568***
Female	95 (94-98)-***Ref***	143 (127-160)-***Ref***	95 (92-98)-***Ref***	136 (103-170)-***Ref***
Age-group	*<0.001 (2)* §	*0.243 (2)*	*<0.001 (2)*	*0.440 (2)*
18-35 years	90 (88-93)-***0.001***	126 (67-185)-***0.407***	92 (88-96)-***0.001***	154 (71-236)-***0.937***
36-50 years	93 (91-97)-***0.001***	118 (76-159)-***0.130***	94 (90-98)-***0.001***	118 (69-169)-***0.211***
>50 years	102 (100-104)-***Ref***	151 (138-164)-***Ref***	102 (99-105)-***Ref***	150 (129-171)-***Ref***
Education	0*.040 (2)*	*0.551 (2)*	0*.943 (2)*	*0.650 (2)*
level	100 (96-103)-***0.021***	144 (122-167)-***0.841***	96 (92-100)-***0.908***	135 (94-175)-***0.848***
Low	97 (95-99)-***0.079***	157 (138-176)-***0.324***	96 (93-100)-***0.732***	149 (111-187)-***0.585***
Middle	95 (93-97)-***Ref***	141 (116-166)-***Ref***	96 (93-99)-Ref	139 (99-178)-***Ref***
High				
Economic	0*.079 (2*)	*0.484 (2)*	0*.092 (2*)	*0.754 (2)*
status	97 (93-101)-***0.191***	156 (127-185)-***0.259***	96 (91-100)-***0.695***	148 (100-197)-***0.488***
Low	97 (95-99)-***0.025***	151 (135-166)-***0.978***	98 (95-101)-***0.040***	145 (110-180)-***0.481***
Middle	94 (91-97)-***Ref***	130 (95-165)-***Ref***	95 (91-98)-***Ref***	129 (84-173)-***Ref***
High				
BMI	<0*.001 (2)*	*0.888 (2)*	*0.028 (2)*	*0.616 (2)*
Normal	92 (91-95)-***0.001***	144 (118-170)-***0.965***	94 (90-97)-***0.009***	131 (93-168)-***0.577***
Overwieght	97 (95-99)-***0.001***	151 (132-170)-***0.687***	95 (92-98)-***0.027***	149 (110-189)-***0.668***
Obese	103 (100-106)-***Ref***	145 (124-167)-***Ref***	99 (96-103)-***Ref***	142 (101-183)-***Ref***
Health	<0*.001 (2)*	0*.630 (2)*	*0.269 (2)*	*0.574 (2)*
status	105 (99-112)-***0.001***	161 (132-190)-***0.460***	100 (93-106)-***0.131***	153 (108-199)-***0.358***
Poor	100 (97-103)-***0.006***	145 (127-163)-***0.879***	94 (91-98)-***0.785***	135 (96-175)-***0.936***
Average	95 (94-97)-***Ref***	147 (124-171)-***Ref***	95 (92-97)-***Ref***	134 (100-167)-***Ref***
Good				

** Mean fasting glucose level and 95% Confidence Intervals (in parentheses), followed by P-value (statistical significance) of the difference of mean glucose values within the group, according to GLM procedure.*

§ Overall P-value and degrees of freedom (in parentheses).

† This model was simultaneously adjusted for gender, age, education level, economic status, BMI and health status.

In concordance with previous research [30-33], diabetes prevalence in our survey was associated with education level, economic status and BMI.

Even though demographic and socioeconomic factors associated with diabetes mellitus in our survey were similar to those reported in the international literature, the information regarding diabetes management in population settings in Albania remain extremely scarce. Our survey provided with some data regarding this aspect of DM in a sample of adults who are served by primary health care family physicians working in Albania. In the context when a well-designed and professional national guideline for the management and follow-up of individuals affected by diabetes mellitus is available [34], it would be interesting to compare the guideline indicators to those provided by our survey in order to have an idea whether we are succeeding in the management and control of this disease. We made use of fasting blood glucose levels as an indirect indicator of the effectiveness of the national guideline to

control DM in this south eastern European country. Our data showed that, in general, the mean fasting glucose levels among diabetic individuals in Albania are much higher than recommended thresholds. The later ones suggest the fasting glucose level among diabetics to be the same as that of non-diabetic individuals, i.e. between 80-100 mg/dL [34]. Except for 35-50 years old diabetics, the mean fasting glucose levels in our sample ranged from 129 mg/dL to 154 mg/dL, implying an increased risk for future diabetes complications. Indeed, evidence shows that permanent high glucose level might be an important risk factor for diabetes complications ranging from microvascular complications to death [35]. This situation suggests that the management of diabetes in primary health care in Albania is not optimal.

As DM is an incurable disease, the continuity of care is essential for the successful management of this chronic health condition [32,34]. In primary health care settings, this means that health personnel should have access to clinical records of diabetic individuals. However, this could be more difficult in developing countries compared to developed ones [36]. In Albania, the primary health care is supposed to play the “gate-keeping” role of the health system and it is generally well spread across the territory. Therefore, simple interventions could result in considerable improvements regarding the management of diabetic patients [37-39]. These interventions include patient and medical staff education, the establishment of diabetes registries and improved coordination among different stakeholders involved in diabetes control and management, which could be relatively easily implementable in the context of developing countries.

Our survey has several limitations. Definition of diabetes in our study was based on self-reports and, therefore, our findings should be interpreted with caution. Also, the cross-sectional design does not permit to draw conclusions on causal or temporal relationships between dependent and independent variables. Furthermore, it could be affected by information bias mainly regarding the self-reported economic and/or health status. However, the information bias regarding the self-reporting of diabetes is much less probable since in general diabetic adults remember quite well if the doctor has diagnosed them with this condition. On the other hand, the occurrence of selection bias is another limitation of this survey. We tried to overcome this bias by applying a simple random sample of adults, which minimizes the differences between the selection and target population. Yet, notwithstanding the fact that Tirana population is considered to mirror the general Albanian population [22,23,27-29], findings from this study conducted only in Tirana may not be entirely generalized to the overall Albanian population. On the other hand, the strong points of our survey include a relatively large sample of individuals and the use of objective measurements of different indicators such as weight, height and fasting blood glucose level.

4. CONCLUSION

This survey provided fresh information about the prevalence of diabetes mellitus in a population-based sample of Albanian adults based on self-reports and the measurement of fasting glucose levels. The management and control of diabetes mellitus in primary health care settings in Albania is not optimal and this means that diabetic individuals might be exposed to elevated risk for future diabetic complications.

CONSENT

All authors declare that 'written informed consent was obtained from the patient (or other approved parties) for publication of this case report and accompanying images

ETHICAL APPROVAL

The survey was approved by the Albanian Committee of Biomedical Ethics.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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