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Epidemiological and Clinical Study of Diabetes in Immigrants from Bangladesh in Athens *Versus* Greek Patients

GEORGIOS PAPADAKIS[1], THOMAS ZAMPELIS[2], MARIA MICHALOPOULOU[3], KOSTAS KONSTANTOPOULOS[4], THEOFILOS ROSENBERG[5] and STYLIANOS CHATZIPANAGIOTOU[3]

[1]Department of Endocrinology, Metaxa Cancer Hospital, Piraeus, Greece; Departments of [2]Neurology and [3]Medical Biopathology, Aeginition Hospital, Medical School, University of Athens, Athens, Greece; [4]Department of Haematology, and [5]First Surgical Clinic, Laikon University Hospital, Medical School, University of Athens, Athens, Greece

Abstract. *Background/Aim: Greece has experienced a large wave of immigration from Bangladesh. The purpose of this study was to determine whether Bangladeshi immigrants with diabetes have poorer preventive follow-up and diabetes self-care compared to Greek patients. Patients and Methods: A total of 166 patients from Bangladesh and 123 patients from Greece were recruited. Interviews were conducted, a physical examination followed and blood and urine samples were collected. Results: Patients from Bangladesh had worse glycemic control (A1C=7.74±1.6 vs. 7.55±1.7%; p=0.3), and lower high-density lipoprotein levels (33.99±9.4 vs. 44.05±10.43 mg/dl; p=0.037). They were less likely to regularly take their medication for diabetes mellitus, or to follow dietary recommendations. However, fewer of them smoked, and had a significantly lower body mass index than Greek patients. Conclusion: Bangladeshi immigrants are less likely to engage self-care behaviors and have worse glycemic control and less access to medication, laboratory test and healthcare Units.*

The prevalence of diabetes among adults aged 20-70 years is expected to rise to 438 million by 2030 (1). Roughly 80% of people with diabetes live in developing countries (2). Moreover, certain ethnic groups are significantly more affected, such as South Asian populations (3). Asia is the major site of a rapidly emerging diabetes epidemic (2). In South-East Asia more than 72 million adults live with diabetes and 24.3 million with impaired glucose tolerance. Patients with diabetes in South-East Asia will exceed 123 million by 2035 (4). Bangladesh is estimated to be among the top ten countries with the highest number of people with diabetes both currently and projected in the future (5).

Diabetes risk for Asians is related to a greater tendency to adiposity, which increases insulin resistance (6). Asian populations are more insulin-resistant than many other races (7, 8). Abdominal obesity is a characteristic feature in many Asian populations, especially in South-East Asia (9). Moreover, South Asian groups generally have a low rate of glucose disposal and low concentrations of adiponectin, but high leptin concentrations (8). Various studies have highlighted the fact that people from South Asia have a younger age of onset of diabetes, greater upper-body adiposity and lower body mass index (BMI) and higher risk compared to those of nations, whether they live in their land of birth or in a foreign country (10).

There are specific risk factors associated with the rising trend in diabetes prevalence in South Asian. Such risk factors include globalization and industrialization, rural to urban migration, sedentary lifestyle and smoking; social risk factors are awareness of diabetes, cultural and religious taboos, and inadequate healthcare facilities (3).

Several genetic factors involved in susceptibility to diabetes have been studied; many loci that are associated with diabetes have been replicated in European and Asian populations. Genetic variants in the peroxisome proliferator-activated receptor-γ gene (PPARG) are associated with type 2 diabetes mellitus (T2DM). In Asian populations however, a protective effect of the *PPARG**A12Ala allele on insulin resistance and risk of T2DM was not seen consistently (11). Moreover, polymorphisms in the gene encoding transcription-factor-7-like protein 2 (*TCF7L2*) were reported to be associated with T2DM and different genetic variations in *TCF7L2* are

Correspondence to: S. Chatzipanagiotou, Athens Medical School - Aeginition Hospital, Department of Medical Biopathology, Vass. Sophias av. 72-74, 115 28 Athens, Greece. Tel: +30 2107289192, Fax: +30 2106004608, e-mail address: schatzi@med.uoa.gr, schatzipa@gmail.com

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associated with T2DM in Asian populations (12, 13). Several other loci have been associated with the pathophysiology of T2DM in Asian populations; ethnic differences in the frequencies of risky alleles lead to differences in population-attributable risk (14). Another genetic variant, FTO (fat mass and obesity associated) gene, is associated with changes in obesity, which predisposes Asians to diabetes. It seems that there are differences between Asians and Europeans in the mechanisms linking body size with T2DM (15). There are also differences according to type 1 diabetes mellitus (T1DM) and autoantibodies to insulin. These autoantibodies are typically present only among 30-40% of patients with T1DM in Asia, compared to their reported prevalence of 70-80% in Western populations. This may reflect differences in underlying pathophysiology (16). On the other hand, a rising proportion of patients in Asia treated as having T2DM is recognized to have evidence of progressive autoimmune destruction of beta-cells, and therefore a diagnosis of latent autoimmune diabetes in adults is fulfilled (16).

Immigrants, both documented and undocumented, currently constitute approximately 9% of the total population in Greece (17). The country has experienced a large wave of immigration from Asian countries, especially Bangladesh. Immigrant populations are disproportionately affected by diabetes and its complications. Migration to more affluent countries results in a high prevalence of diabetes in many populations (7). Given that Bangladeshis are a growing population and that there is also a lack of previous studies examining their health status and behaviors related to diabetes, the purpose of this study was to explore the ethnic differences and special needs that must be taken into account when treating these patients.

Parients and Methods

A total of 166 randomly selected immigrants with diabetes from Bangladesh were compared with 123 randomly selected Greek Caucasian patients with diabetes. Patients were recruited through community outreach, hospital-based diabetes clinics and immigrant-serving organizations between 2010 and 2013. Only patients who were willing to participate during their visit were recruited and interviewed. Participants with serious health problems (*e.g.* terminal illness) were excluded.

A questionnaire was formulated and pilot-tested for the comprehensibility of questions by both ethnic groups. All materials were developed in English, translated into Bengali by a certified translator, and all patients from Bangladesh completed the in-person survey with a bilingual research assistant. Interviews were conducted, a physical examination followed and blood and urine samples were collected.

All blood examinations were performed after informed patient consent (all the necessary documents were given to the patients in their native language).

Demographic characteristics were assessed. These included age, gender, marital status, and years of education, number of years living in Greece and employment status.

Diabetes-related information was collected, including the type of diabetes, the length of time since diagnosis, family history of diabetes and any diabetes complications. Patients were asked if they had any history of heart attack or stroke, dental or periodontal disease, any history of diabetic ketoacidosis and history of hypoglycemia over the previous six months. Additionally, patients were asked if they had polyuria symptoms or any gastrointestinal complaints, sexual problems, erectile dysfunction or any other medical history. They were also asked what treatment they followed for diabetes, whether they used insulin or antidiabetic agents, or both. Moreover, they were asked if they used any anti-hypertensive agents, lipid-lowering agents and any medication for depression.

Obesity risk was determined and calculated based on height, weight, BMI and waist circumference. Blood pressure was determined as the mean of two separate measurements in the sitting position. All the patients underwent a foot screening test and were examined for any callus, ulcers, macerations, redness, bunions, mycotic, thickened or ingrowing nails, and fungal infections.

Participants were asked to report how often they had their blood glucose checked per week, if they had their feet regularly checked and if they took their medication regularly. They were also asked to give information about their current smoking status and if they engaged in any type of physical activity. They were also asked to what extent they followed dietary recommendations for diabetes. Bangladeshi immigrants were also asked if they fasted during Ramadan.

Plasma glucose, glycated hemoglobin (A1C), plasma total cholesterol and triglycerides, high-density lipoprotein (HDL) cholesterol and low-density lipoprotein (LDL) cholesterol, serum glutamic oxaloacetic transaminase (SGOT), serum glutamic pyruvate transaminase (SGPT), gamma-glutamyl transpeptidase (γGT), lactate dehydrogenase (LDH), creatine phosphokinase (CPK), C-reactive protein (CRP), uric acid and urine glucose, proteins and ketones were measured for all patients. All the blood samples were analyzed at Aeginition Hospital, Department of Medical Biopathology.

Data were analyzed using SPSS analytical software 22 (SPSS Inc – IBM Corporation, New York, United States). Chi-square tests (for differences of proportions) and *t*-tests (for differences in means) were used. Variables with *p*-values of less than 0.05 were considered significant upon analysis.

Results

Patients from Bangladesh had a mean duration of living in Greece of 10.34±6.2 years. The Bangladeshi group was younger compared to the Greek group (44.05±8.1 *vs.* 48.75±9.2 years old, $p=0.009$) and had an earlier age at onset of diabetes (39.3±7.3 *vs.* 41.7±10.1 years old, $p=0.025$). The reported duration of diabetes was lower in the Bangladeshi group (4.86±4.5 *vs.* 7.34±6.21 years, $p<0.05$). The Bangladeshi group had a significantly lower BMI (24.19±3.3 *vs.* 29.04±8.7 kg/m^2, $p=0.01$), and waist circumference (92.2±8.9 *vs.* 103.1±15.7 cm, $p<0.001$). There was no difference in the number of family members with diabetes mellitus in the two groups (Bangladeshi group=0.73±1 *vs.* Greek group=0.94±0.9 family members, $p=0.09$). Despite being younger and having a shorter duration of diabetes, the

Table I. *Laboratory parameters in Bangladeshi (BP) and Greek (GP) patients with diabetes.*

Variable	BP group (n=166)	GP group (n=123)	*p*-Value
Creatinine (mg/dl)	1.10±0.18	0.99±0.25	0.47
SGOT (U/l)	24.59±14.3	24.49±32.8	0.10
SGPT (U/l)	24.99±28.1	21.21±23.9	0.79
γGT (U/l)	43±33.1	41.6±60.27	0.05
LDH (U/l)	310.08±81.3	303.11±69.8	0.11
CPK (U/l)	149.97±111	141.17±106.32	0.76
Amylase (U/l)	72.47±30.7	67.80±31.51	0.43
CRP (mg/dl)	0.73±2.43	0.52±0.78	0.45
Urea (mg/dl)	29.12±8.27	34.37±10.77	0.05
Uric acid (mg/dl)	5.05±2.48	5.57±1.43	0.88
Positive urine glucose	52.4	39.8	0.03
Positive urine ketones	3	0.8	0.19
Positive urine protein	3.7	7.3	0.16

Table II. *Demographic and clinical data of Bangladeshi (BP) and Greek (GP) patients.*

Variable	BP group (n=166)	GP group (n=123)	*p*-Value
Male	90.4	82.9	0.061
Permanently employed	56.4	57.7	0.818
With T1DM	7.2	12.2	
With T2DM	74.7	66.7	
With T2DM insulin treated	18.1	21.2	
Illiterate	15.1	3.3	
Attended elementary school	25.3	16.3	
Attended high school	50.6	61.8	
With college/university degree or higher	8.4	18.7	
Living with partner	16.3	96.7	<0.0001
Regular exercise	7.2	12.2	0.037
Walk more than 30 minutes daily	65.9	34.1	0.001
Follow dietary recommendation	32.5	61.8	<0.0001
Fast during Ramadan	61.4		
Take their medicines every day	68.1	93.5	<0.0001
Check their feet regular	14.5	50.4	<0.0001
Smokers	24.1	47.2	
Ex-smokers	10.8	30.1	
Not smokers	65.1	22.8	
With blood tests in the previous year	17.5	76.4	<0.0001
Reached lipid profile goal*	4.2	14.6	0.002
Blood pressure <130/80 mmHg	75.3	69.9	0.308
Diabetes under control (A1C <7%)	29.1	37.4	0.137
History of heart attack	6.6	10.6	0.230
History of stroke	4.2	1.6	0.210
Periodontal disease	36.7	39.0	0.693
History of ketoacidosis	6.6	15.4	0.015
History of hypoglycemia during the past six months	12.7	30.9	<0.0001
With polyuria symptoms	45.8	44.7	0.857
With gastrointestinal complaints	30.7	20.3	0.047
Win sexual problem	49.4	36.6	0.030
With mycotic nails	50.6	39.8	0.069
With pre-ulcer on the feet	8.4	0.8	0.047
With callus on the feet	6.6	1.6	0.047
Use anti-hypertensive agents	19.9	47.5	<0.0001
Use medication for depression	7.2	10.6	0.318
Use lipid-lowering agents	6.7	41.5	<0.0001

*LDL <100 mg/dl, TGL <150 mg/dl and HDL >40 for women and >50 mg/dl for men. A1C: Glycated hemoglobin , HDL: high-density lipoprotein cholesterol, LDL: low-density lipoprotein cholesterol, SGOT: serum glutamic oxaloacetic transaminase, SGPT: serum glutamic pyruvate transaminase, γGT: gamma-glutamyl transpeptidase, LDH: lactate dehydrogenase, CPK: creatine phosphokinase, CRP: C-reactive protein, TGL: triglycerides.

Bangladeshi group had a slightly worse, but not statistically significant, glycemic control compared to the Greek group (A1C= 7.74±1.6 % *vs*. 7.55±1.7%, p=0.3). A significant number of Bangladeshis stated that they rarely checked their self-monitoring blood glucose compared to the Greek group (1.26±2.6 *vs*. 8.87±9.9 times per week, p<0.01). There was no difference between the two groups in mean systolic blood pressure (Bangladeshi group=122.3±18.7 mmHg *vs*. Greek group=121.81±13.3 mmHg, p=0.005).

There were also no significant differences between the two groups for most laboratory findings, although Bangladeshis had higher mean levels of glucose (190.3±72 *vs*. 160.8±81 mg/dl, p=0.4), cholesterol (199.8±44.4 *vs*. 178.86±44.9 mg/dl, p=0.9), LDL (129.3±33.2 *vs*. 110.62±33.9 mg/dl, p=0.8) and triglycerides (231.4±213 *vs*. 181.95±166 mg/dl, p=0.07). In the Bangladeshi group, the mean HDL level was significantly lower as compared with the Greek group (33.99±9.4 *vs*. 44.05±10.43 mg/dl, p=0.037). The rest of the laboratory findings are presented in Table I. Demographic and clinical data are presented in Table II.

Discussion

Immigrants seem to be more vulnerable to social and economic disadvantage and this affects health outcomes and access to health care. A lower socioeconomic status is associated with a higher prevalence of diabetes (18). Even though health policies deal with the issue of inequalities in health care, there is no clear evidence about the health status of the approximately one million immigrants currently living in Greece or of their access to healthcare units (19).

The reported prevalence of diabetes was found to be higher in immigrant South Asians compared to those in their homeland. When compared to the host populations in Europe, Canada and United States, prevalence rates were higher for immigrant South Asians (20-22). Studies regarding the health literacy and use of healthcare services by immigrants in Greece are essential but unfortunately they are lacking.

Bangladeshis were found to have a lower level of education than the Greek group, that is also reflected in in

their health literacy. This affects the patients' ability to interpret blood glucose levels, to understand early symptoms and complications related to diabetes, and to follow medical instructions correctly. Lack of Greek language proficiency may also limit their access to mainstream health care.

The majority of participants from Bangladesh were male as it is common for men to move alone to Greece. They also live together with other men from their country in the same places. Only 16.3% of the patients from Bangladesh moved together with their families. The mean residence time in Greece was 10.34±6.2 years, which possibly means that most Bangladeshi immigrants come to Greece for a very long time and tend to stay permanently. Factors such as employment status, level of education, social class, housing tenure, household income and number of people in the household, may influence food choices, lifestyle and access to health care.

In our study, patients from Bangladesh were younger than Greek patients. South Asians develop diabetes at a younger age than Europeans, as reported in other studies (23-25). In our study, Bangladeshis also seemed to have a shorter reported duration of diabetes (4.86±4.5 *vs*. 7.34±6.21 years, $p<0.05$), which could be attributed to less regular blood tests. So it is highly possibly that Bangladeshis are diagnosed later in the progression of diabetes, as they possibly lack screening tests and health-seeking behavior.

Patients from Bangladesh did not regularly follow dietary recommendations. Polished rice and refined wheat form the basis of most Asian diets, with a high glycemic index and glycemic load. Immigrants who move to Greece often change their dietary habits and consume higher quantities of foods of animal origin, refined carbohydrates, processed foods, saturated and total fat and less fibre. Moreover, immigrants from Bangladesh are much less physically active than other ethnic groups (26). In our study, the majority of Bangladeshi took no physical activity.

In our study, Bangladeshi generally had a lower BMI than did Greeks. Asian populations seem to differ from European populations in associations between BMI and percentage of body fat and health risks. For Asian patients, the criteria for BMI are a healthy value of 18.0-22.9 kg/ m^2, overweight of 23.0-24.9 kg/m^2, and obesity at 25 kg/m^2 or more (27). Moreover, abdominal obesity is a particular characteristic in Southeast Asians population. Insulin resistance is associated with visceral and subcutaneous fat content (19). The 'metabolically obese' phenotype (*i.e*. normal body weight with increased abdominal adiposity) is common in Bangladeshi patients with diabetes.

Additionally, it appears that many Bangladeshi patients had a less favorable lipoprotein profile. They tended to have significantly lower HDL level compared to Greek patients. They were also less likely to follow lipid-lowering therapy. South Asians are predisposed to adverse lipid profiles (28). Given our finding of a significantly less lipid-lowering therapy in South Asians, combined with the greater propensity for coronary heart disease in South Asians generally, and also in those with diabetes (29), the need for lipid-lowering therapy is crucial in this population.

Moreover, Bangladeshi patients seemed to follow their prescribed treatment and perform regular blood testing more rarely, which may be related to the less frequent health insurance coverage in comparison to native populations and economic burden of diabetes care. Apart from this, immigrants face multiple barriers in accessing healthcare services in Greece. For all these reasons, many immigrants remain untreated and are more vulnerable to the complications of diabetes. The poorest economic strata bear the highest cost burden of diabetes treatment, and the economic cost increases many-fold with the development of vascular complications. This may lead to higher healthcare expenditure in the long run, raising serious concerns about the sustainability of the Greek Health System, especially during the current economic crisis.

The present study underlines that immigrant groups are also less likely to engage self-care behaviors and seem to have worse glycemic control and less access to medication, laboratory test and healthcare units. The size of the immigrant Bangladeshi population will continue to increase in coming years and Bangladeshis will turn to the Greek National Health System to treat the complications of untreated diabetes mellitus. Moreover, effective, early and culturally-tailored health intervention programs are needed to overcome barriers and provide support for diabetes management. Providing diabetes education at the community level is important to raise public awareness of diabetes and to eliminate social stigma. Public health policy measures related to appropriate coverage and adaptation of existing best practices should be taken, so that the system can respond better to the increasing numbers of immigrants.

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