Screening for Diabetes among Roma People Living in Serbia

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Aim To investigate the prevalence of diabetes in the Roma population in Serbia.

Methods We screened 11 urban and 8 rural Roma communities from October 2006 to May 2008 for the presence of diabetes. Blood glucose values, name, age, sex, presence of diabetes, family history, and obesity were recorded.

Results We analyzed the data from 1465 Roma people, 953 women and 512 men (785 in urban and 680 in rural communities), with mean age of 42.42 ± 15.69 years. Abdominal obesity was present in 600 (41%) participants. Eighty seven participants (5.9%) already had diabetes and there were 76 (5.2%) newly discovered cases of diabetes type 2. Participants with diabetes were significantly older ($F = 28.33$; $P < 0.01$). Family history for diabetes was positive in a third of participants. The risk for diabetes was 3.48 times higher in participants with positive family history (odds ratio [OR], 3.47; 95% confidence interval [CI], 2.37-5.1; $P < 0.01$). Abdominal obesity was less frequent in healthy participants than in participants with diabetes ($X^2 = 32.55$; $P < 0.01$). The risk of diabetes in participants with abdominal obesity was 2 times higher than in the non-obese (OR, 2.11; 95% CI, 1.24-3.55; $P < 0.01$). Diabetes was significantly more present in urban communities ($X^2 = 25.20$; $P < 0.01$). The risk of developing diabetes was 3.65 times higher in participants from urban settlements (OR, 3.64; 95% CI, 1.99-6.66; $P < 0.01$).

Conclusion Prevalence of diabetes in the Roma people living in Serbia may possibly be higher than in the general population of Serbia and needs further investigation.

The prevalence of diabetes in the Roma people in Serbia and other countries is unknown. According to the Atlas of the International Diabetes Federation, the prevalence of diabetes in Serbia in 2003 was 5.6% (1). However, the Institute for Public Health of Republic of Serbia stated that at the end of 2006 there were about 500 000 people with diabetes, or 6.7% of the population (2). It is also unknown how many Roma people have settled in Serbia in the last 10 years as refugees from Bosnia, Macedonia, and Kosovo and how many have returned from the West and Central European countries because of job loss. According to 2002 Census, 108 193 or 1.44% of the population declared themselves as the Roma people (3). However, the Council of Europe estimates that 400 000 to 800 000 Roma live in Serbia without Kosovo, declaring themselves as Serbs or Moslems (4). Some of them have neither identity cards nor social security.

The Roma people in Serbia live in closed communities. Some of these communities are located in the city suburbs, often under the bridges or near the railways, and have poor living conditions with street pumps as the only source of water supply, houses of very basic construction, and no heating supply. Other urban settlements are very decent, with brick houses, and water and electricity supply. Rural Roma settlements are more uniform, with appropriate sewage, water, and electricity supply (5). Although education in primary schools is free for all in the Republic of Serbia, only 33% of Roma children finish primary school and only 9% of the Roma finish secondary school. Some of them speak only the Romani language, which makes it difficult for them to find a job. The social status of the Roma people living in Serbia is, therefore, characterized by extremely low level of education and very high level of unemployment.

In 2002, three most common causes of death in the Roma population were cardiovascular (44%), malignant (20%), and respiratory (6%) diseases (6). However, this population may be at an increased risk for diabetes because of poverty, obesity, and stress caused by frequent migrations. The aim of our study was to investigate the presence of diabetes in the Roma population in Serbia.

PARTICIPANTS AND METHODS

From October 2006 to May 2008, the Diabetes Association of Serbia performed blood glucose testing in Roma settlements in Serbia. The activity was inspired by World Diabetes Day topic in 2006, "Diabetes in the disadvantaged and the vulnerable." International Diabetes Federation suggest-

ed that all member associations should do blood glucose testing in ambiguous populations, if present in their countries, or in people who are disadvantaged in terms of access to diabetes care (7).

In order to conduct the survey, Diabetes Association of Serbia contacted 8 April Roma Community Center in Belgrade. Mr Dragoljub Acković, the head of the organization and the Vice President of the World Roma Parliament, supported our activity because, as he said, it increased the awareness of diabetes in the Roma population and was in accordance with "A Decade of Roma inclusion 2005-2015" objectives. He suggested 11 urban and 8 rural settlements at which 100 to 150 readings should be easily done and made contacts with the local Roma people. Hence, it was decided to do 2000 blood glucose readings in the Roma participants. The 8 April Roma Community Center also engaged local guides in each community. The 11 urban settlements were the following: 4 in Belgrade (Marinkova Bara, Deponija, Mali Mokri Lug, and Mali Leskovac) and 1 in each of the following cities: Požarevac, Obrenovac, Ub, Aleksinac, Leskovac, Vranje, and Pirot. The 8 rural settlements were Ripanj and Lazarevac near Belgrade, Kostolac near Požarevac, Trebešinje and Vranjska Banja near Vranje, Berilovac and Gradašnica near Pirot, and a rural settlement in Vlasotince.

The local guides announced the event to the Roma people, provided a place for the activity, and secured the attendance of the local people. Sometimes, this was not possible because people were not interested or were suspicious, or only women and children came to the meeting. Hence, blood glucose measurements were mostly collected by going from house to house, or in the streets in front of local shops where people gathered, and very rarely in organized facilities. Local guides helped us to make conversation and note down the names and answers to the questions. To do the planned 2000 blood glucose measurements, we needed time, patience, and skilled personnel. The personnel consisted of volunteers from the Diabetes Association of Serbia, physicians, or lay people with diabetes. It was agreed with the Roma leaders that it was not necessary to obtain a verbal informed consent from each Roma participant. The study was approved by the Ethics committee of the Diabetes Association of Serbia in September 2006.

Capillary blood glucose measurements were performed with the One Touch Ultra blood glucose meters (Life Scan, Milpitas, CA, USA) because this instrument converts capillary blood glucose values into plasma glu-

cose values and has minimal human error in performing readings (8,9). Only people older than 18 years were taken into consideration, although younger ones, especially teenagers, were tested as well. The following data were gathered: name, age, presence of diabetes, presence of diabetes in the family, the time of the last meal, and sex. Abdominal obesity was assessed by visual inspection. It was not possible to perform measurements of waist circumference or of body weight because the Roma activists told us that the Roma people are not happy to be physically examined. Body mass index could not be calculated without height measurements. One physician was allocated to assess the presence of abdominal obesity visually: if the abdomen was considerably protruding over the plain drawn vertically upwards from anterior superior iliac spine to the rib cage, the person was considered abdominally obese.

In order to realistically assess blood glucose values, we asked the participants to indicate the time of their last meal (10). None of the measurements were done before 10 AM. At 3 locations, activities started at 3 PM and the last measurements were made at 6 PM. So, if the person stated that they had not had a meal until the moment of measurement, normal glucose values were considered to be those below or equal to 6 mmol/L. If the readings were between 6 and 7 mmol/L, they were noted as "unclear." The person was told that they were likely to have diabetes and instructed to visit the primary health care unit for a test of fasting plasma glucose value. The participant was also advised to report the fasting value to the local guide, who then forwarded this information to us to complete the database. If a person had the capillary glucose reading of 7 mmol/L or higher before taking any meal, they were told that that they probably had diabetes and advised to visit the primary health care unit for retesting, registration, and treatment.

If the person had taken food, all capillary blood glucose values below or equal to 7.8 mmol/L were considered normal. If the measured value was 11 mmol/L or higher, the person was told that they had diabetes and advised to visit the primary health care unit. If the values were between 7.8 and 11 mmol/L, the readings were noted as "unclear." People were advised to do a fasting plasma glucose value re-check in the primary health care unit and to report it to the local guides.

Statistical analysis

All data were analyzed using SPSS, version 10.0 (SPSS Inc, Chicago, IL, USA). ANOVA test was used to com-

pare the difference in mean age between the 4 groups: people with already established diabetes, people with newly diagnosed diabetes, people with unclear results, and healthy people. Chi-square test was used to analyze the difference between the 4 groups related to positive family history, abdominal obesity, and the location of Roma settlements. Multinomial logistic regression was used to analyze the risk (odds ratio [OR], and 95% confidence interval [CI]) of developing diabetes in participants with positive family history, participants with abdominal obesity, and participants living in urban or rural settlements. Differences were considered significant at the level of $P < 0.05$.

RESULTS

We performed 2015 blood glucose measurements. However, due to the specific nature of the measurement collection in the field, there were a number of incomplete results or readings, which could not be taken into account. Teenagers were eager to have their blood glucose readings taken, but only the participants older than 18 years could be included. The local guides noted the name, answers to the questions, and blood glucose readings, but not the sex, thinking that sex was obvious. However this presented the problem for the evaluators, because Roma names could not be easily related to sex. Visual assessment of abdominal obesity was frequently missing, as the Roma people, especially male participants, did not wait for examination after having obtained blood glucose readings. Men were usually less cooperative, did not attend organized events in provided facilities, and did not like to have the blood glucose readings taken. Complete results were obtained for only 1465 participants, 953 female and 512 male. Statistical analysis was done on this sample.

The mean age of the participants was 42.4 ± 15.6 years, with most of the participants being in the 35-54 age group (545 participants, 38.2%). Fewer measurements were performed in the age group 54-64 years (499 measurements, 27.4%), followed by the age group 18-35 years (326 participants, 28.9%), and the age group older than 65 years (95 measurements, 5.6%).

Regarding the type of the Roma community, 785 (53.6%) blood glucose measurements were done in urban and 680 (46.4%) in the rural setting. Complete results were obtained for 526 female (62.2%) and 259 male (37.7%) participants in urban settlements and for 427 female (68.6%) and 253 male (31.4%) participants in rural settlements.

There were 600 (41%) participants with abdominal obesity, more of whom were female (n = 410, 68.4% vs n = 190, 31.6%). Normal body built was recorded for 865 or 59% of participants (543 women, 62.8% and 322 men, 37.2%).

Diabetes was already present in 87 (5.9%) of 1465 participants. Only 2 of them had type 1 and others had type 2 diabetes. Blood glucose screening revealed another 76 (5.2%) new cases, all with type 2 diabetes. Diabetes was not present in 72% of the Roma people. There were many ambiguous results (n = 247).

ANOVA testing revealed significant difference (F = 28.33; $P < 0.01$) in the age of participants who already had established diabetes, newly discovered cases, and participants with ambiguous results, in comparison with participants without diabetes. Participants with diabetes were 52.6 ± 12.8 years old, newly discovered cases were

50.4 ± 17.2 years old, and participants with ambiguous results were 46.3 ± 16.3 years old. Participants without diabetes were significantly younger, with a mean age of 40.1 ± 16.2 years.

Family history for diabetes was positive in a third of participants. Participants with diabetes had significantly more often positive family history than healthy participants ($\chi^2 = 53.64$; $P < 0.01$) (Table 1). Multinomial logistic regression analysis revealed that the risk of developing diabetes in a participant with positive family history was 3.48 times higher than in participants with negative family history (OR, 3.47; 95% CI, 2.37-5.1; $P < 0.01$). Sixty eight participants with ambiguous blood glucose results and positive family history did not have a greater risk for diabetes than healthy participants.

Abdominal obesity was less frequent in healthy participants than in participants with diabetes ($\chi^2 = 32.55$; $P < 0.01$) (Table 2). Multinomial logistic regression analysis revealed that the risk of developing diabetes was 2 time higher in participants with abdominal obesity than in those with normal body built (OR, 2.11; 95% CI, 1.24-3.55; $P < 0.01$). Even the participants with abdominal obesity and ambiguous results had a 2.2 times greater risk of diabetes than participants of normal built (OR, 2.16; 95% CI, 1.58-2.96; $P < 0.01$).

Diabetes was significantly more present in urban Roma settlements ($\chi^2 = 25.20$; $P < 0.01$) (Table 3). The risk for developing diabetes was 3.65 times higher in participants living in urban communities than in those living in rural communities (OR, 3.64; 95% CI 1.99-6.66; $P < 0.01$).

TABLE 1. Family history in Roma people with diabetes, new cases of diabetes, people without diabetes, and those with ambiguous results

Screening result	Family history (No., %)		Total
	positive	negative	
With diabetes	56 (66.7)	29 (33.3)	87
Newly discovered	33 (43.1)	43 (56.9)	76
Ambiguous results	68 (27.5)	179 (72.5)	247
Healthy	282 (26.7)	773 (73.3)	1055
Total	441 (30.1)	1024 (69.9)	1465

TABLE 2. Presence of abdominal obesity in Roma people with diabetes, new cases of diabetes, people without diabetes and those with ambiguous results

Screening result	Abdominal obesity (No., %)		Total
	positive	negative	
With diabetes	45 (52.2)	42 (47.8)	87
Newly discovered	41 (54.1)	35 (45.9)	76
Ambiguous results	135 (54.8)	112 (45.2)	247
Healthy	379 (35.9)	676 (64.1)	1055
Total	600 (41.0)	865 (59.0)	1465

TABLE 3. Living community in Roma people with diabetes, new cases of diabetes, people without diabetes, and those with ambiguous results

Screening result	Community (No., %)		Total
	urban	rural	
With diabetes	69 (79.7)	18 (20.3)	87
Newly discovered	51 (67.2)	25 (32.8)	76
Ambiguous results	118 (47.7)	129 (52.3)	247
Healthy	547 (51.8)	508 (48.2)	1055
Total	785 (53.6)	680 (46.4)	1465

DISCUSSION

Our study showed that 11.1% of the Roma participants who were screened had diabetes and that the prevalence of diabetes in the Roma people may be higher than in the general population of Serbia. It emphasized the importance of capillary blood glucose testing in the Roma participants with risk factors such as obesity, family history, and urban way of life. The number of newly discovered cases of diabetes almost equaled the number of known cases. This shows that on every person with diabetes in the Roma population in Serbia, there is one more in whom diabetes is yet to be discovered.

We are aware of the limitations of our study. The screened population was chosen by the Roma lead-

ers in a way to cover the regions of Serbia with greater number of the Roma people. It might not represent the whole Roma population living in Serbia, but gives a clear picture of the presence of diabetes.

The Roma population in Europe is estimated between 4 and 10 million, most of which is concentrated in Central European and Balkan countries, amounting to 5% of the population (11). During the last decade, several studies dealing with diverse problems of the Roma population have been conducted in the South-Eastern Europe (12-14). However, they have not estimated the prevalence of diabetes. A small survey on diabetes was done in Slovakia, but the population studied was too small to make any valid conclusion (15). Our study represents the first attempt to clarify this serious health problem.

Diabetes prevalence increases with age. The Roma participants with already established diabetes and the newly discovered ones were older than Roma people with normal glucose values. However, it is to be noted that the average age of our Roma participants differs from the average age of Serbian people at the time of diabetes diagnosis. In 2006, there were 18 000 people with newly discovered diabetes in Serbia, mostly in the age group 65-69 years (2). The average age of the Roma people with newly discovered diabetes in our study was 50.4 ± 17.2 years. It is well known that the life expectancy of the Roma people is 10 years shorter than the general population (16). This explains why so few blood glucose measurements were done in participants over 65 years of age. It is not easy to explain why diabetes appears earlier in the Roma people. The number of our participants is too small to make any conclusion and further investigation is needed. The well accepted guidelines of the International Diabetes Federation (17) suggest screening for diabetes in all people older than 45 years. This may well apply to the Roma people.

Positive family history for diabetes was discovered in one third of the Roma participants. Those with already established diabetes and newly discovered cases had a higher presence of positive family history than healthy participants. It is well known that diabetes type 2 is more frequent in some nations and indigenous communities (18). Genetic predisposition of the Roma people for some diseases has been investigated (19), but not for diabetes. Hence, screening for diabetes should be performed on a yearly basis in all the Roma people with positive family history of diabetes.

Obesity is a public health problem in Serbia. According to the study done in 2003, 8.2% of the population in Serbia is obese, while 29.4% is morbidly obese (20). This study did not study the presence of abdominal obesity. The Roma people, especially female participants, are considered obese (21). In our study, abdominal obesity was present in 41% of the Roma people (28.9% in female and 12.1% in male participants). We are fully aware that the lack waist circumference measurement is a limitation of the study. However, abdominal obesity was clearly visible and this is considered as a reasonable method for assessing adiposity in most instances (22). It has not been proven whether calculation of the body mass index, waist-hip ratio, or simple measurement of waist circumference gives a better measurement of obesity. However, abdominal obesity, measured as waist circumference, is associated with coronary heart disease and all cause mortality (23,24).

People with type 2 diabetes are usually obese and have a considerable cardiovascular risk (25). Even in our study, participants with diabetes were more abdominally obese than participants with normal glucose values. Abdominal obesity carried a twice greater risk for diabetes. As the Roma people suffer primarily from cardiovascular diseases, a two times greater risk for diabetes in Roma participants with abdominal obesity stresses the importance of screening for diabetes. However, none of the Roma participants with ambiguous result and only 2 of them with newly discovered diabetes went to the primary health care units. The reason for this is that the Roma people tend to treat a health problem only when they are bed ridden (26). Hence, screening for diabetes alone is not enough and should be followed by organized health care and education.

Living in the cities is not considered as a risk factor for diabetes. However, life of the Roma people in urban settlements is very different from the life of other urban inhabitants. There often basic living conditions are not met, ie, there is lack of water, sewage, or electricity supply, while poverty, migrations, and unemployment generate everyday tensions. The Roma people living in Serbia have identity cards and free social security. However, even when access to health care is provided, they use it infrequently (27).

In our study, diabetes was significantly more present in urban than in rural Roma settlements. A significantly increased risk of 3.65 times for developing diabetes was found in the Roma people living in urban communities. The prevalence of poverty, defined as an average total consumption below the poverty line of € 57 per month/

consumption unit, in the Roma population is as high as 64.4%, which is 6.1 times more frequent than in the general population of Serbia (28). Poverty is considered a risk factor for diabetes by the International Diabetes Federation. In the poor, who avoid visiting the physician, such as the Roma people, diabetes must be searched for. Screening of the Roma people with risk factors is the only way to discover diabetes.

The health of the Roma people has begun to receive increasing attention after 8 countries in the Central and Eastern Europe, including Serbia, declared 2005-2015 decade "The Decade of Roma inclusion," with an aim to ensure better health care, employment, and education. However, the health status of the Roma population still remains unknown (29,30). Our results could contribute to increasing awareness of the problem of diabetes type 2 and obesity in the Roma people, as preventable risk factors for cardiovascular disease.

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