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Prevalence of diabetes mellitus in North-Western Tanzania

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Summary. The prevalence of diabetes mellitus in 3,145 Tanzanian Africans living in three different areas of the country was studied. Fasting capillary blood glucose concentrations were measured by Dextrometer and if the levels were ≥ 5.5 mmol/l an oral glucose tolerance test was performed. When using the 1980 WHO criteria [8] for diagnosis, the overall diabetic prevalence was 0.7%. Prevalence increased with age, and in the population ≥ 20 years of age it was 1.6%. In a rural area inhabitated by the Haya tribe, the prevalence in the population aged ≥ 20 years was 2.5%, and in a similar area populated by the Sukuma tribe it was 0.5%. In the urban area of Mwanza town it was 1.9%. Obesity was seen in 3.7% of the population and in 9.1% of the diabetic subjects. Sixty-eight percent of the diabetic patients were female compared with 53% in the general population. None of the diabetic patients discovered had any symptoms. Thus, the overall prevalence of diabetes in Tanzania is rather low but shows geographical variability and is strongly associated with age.

Key words: Diabetes, Tanzania, prevalence, obesity, fasting glucose.

Diabetes mellitus has a global distribution but from reported studies it is concluded that the prevalence of the disease varies considerably between different countries and between different ethnic groups [1]. The information in this respect from Africa is sparse; earlier studies have shown prevalence rates varying between 0.2% and 1.2% [2–5]. From Tanzania, no epidemiological diabetic information has been published but from clinical observations an increasing prevalence is suggested [6, 7], at least in some areas.

The aim of the present study was to give an estimation of the prevalence of diabetes in three different areas of Tanzania. Two rural areas, populated by two different tribes, and one urban area were selected for this purpose. Fasting blood glucose concentrations were measured in all individuals within defined geographical areas.

Subjects and methods

Subjects

The study was performed during the period October 1982 – March 1983 in three different areas in north-western Tanzania, two rural and one urban. The urban area was a ward (Kitangiri) in Mwanza town, the third biggest town in the country after Dar es Salaam and Tanga, situated at the southern edge of Lake Victoria. The Kitangiri ward has 3000 inhabitants originating from several tribes, mainly industrial workers or government or business officials. The basic foods in this ward are maize and rice.

The two rural areas were Kahangala village, situated 60 km north-east of Mwanza on the main road to Musoma, and two joined villages (Kizigo and Bushagara) situated near Ndolage Hospital, 60 km south of Bukoba town on a minor road to the west of Lake Victoria. Kahangala village has a total of 4000 inhabitants, all of the Sukuma tribe. The staple foods are maize and cassava. The Ndolage villages have 1227 inhabitants, all of the Haya tribe, with cooking bananas as the staple food. Beside dietary differences the physical environment between these two areas varies. Thus, the climate is hotter in the Mwanza area than in the Bukoba area, and the degree of physical activity is higher among the Sukuma tribe, partly because of varying farming techniques. In Kahangala village the people are mainly engaged in subsistence farming, fishing or herding cattle. With the latter they can walk several miles daily. In the Ndolage villages all people are subsistence farmers. The two tribes differ also in history and language, but both are of Bantu origin. Villagers from both tribes consume alcohol, mainly local brews, and coffee or tea with sugar. In the villages they consume only a small amount of refined imported food, whereas in Mwanza town the consumption of refined food, as well as sugar and alcohol, is higher. In addition, the changing social situation with a migration to a cash economy in the town gives a potential source of stress.

Survey procedure

In Tanzania, the people are organised at the local level in ten-cell systems, each consisting of ten households under a leader. Through the

Table 1. Age and sex distribution in the three different populations studied

Population	Sex	Age groups (years)								Total	
		⩽9	10–19	20–29	30–39	40–49	50–59	60–69	⩾70		
Ndolage	M	229	102	34	33	32	33	32	22	517	1141
($n=1141$)	F	258	106	70	39	58	46	26	21	624	
Kahangala	M	210	112	43	40	41	25	13	12	496	996
($n=996$)	F	178	93	92	48	49	23	12	5	500	
Mwanza	M	138	153	62	52	28	13	4	2	452	1008
($n=1008$)	F	164	177	114	50	25	12	6	8	556	
Total	M	577	367	139	125	101	71	49	36	1465 (47%)	
	F	600	376	276	137	132	81	44	34	1680 (53%)	
Total	Number	1177	743	415	262	233	152	93	70	3145	
	%	37.4	23.6	13.2	8.3	7.4	4.8	3.0	2.2		

Table 2. Age and sex distribution of the diabetic cases in two of the populations

Population	Age groups (years)	Males		Females		Total	
		Number	(%)	Number	(%)	Number	(%)
Ndolage	0–19	0	0.0	1	0.28	1	0.14
($n=1141$)	20–39	0	0.0	2	1.83	2	1.13
	40–59	2	3.08	3	2.89	5	2.96
	⩾ 60	2	3.70	2	4.26	4	3.96
	total	4	0.76	8	1.31	12	1.05
	⩾ 20	4	2.15	7	2.69	11	2.47
Mwanza	0–19	0	0.0	1	0.29	1	0.16
($n=1008$)	20–39	1	0.89	0	0.0	1	0.36
	40–59	1	2.43	2	5.40	3	3.85
	⩾ 60	1	16.7	2	14.3	3	15.0
	total	3	0.67	5	0.89	8	0.79
	⩾ 20	3	1.87	4	1.86	7	1.86

leaders the names of all inhabitants in every cell were collected. For each cell selected, all subjects were invited to present themselves, fasting, on a particular morning at the house of the leader. In the Ndolage villages all cells were invited for the study, whereas in Kahangala 15 and in Mwanza five cells were selected. Those selected were representative of the whole village and ward, respectively.

Capillary blood was taken and immediately analysed for blood glucose concentration in a portable Dextrometer (Ames Division, Miles Laboratories, Slough, Bucks., UK) using commercially available strips (Dextrostix). The height and weight of the people were also recorded. Those who did not attend were offered a second or third opportunity to do so. With this technique the ascertainment rate was very high (Ndolage 93%, Mwanza town 95% and Kahangala 85%) and was independent of age and sex. Those with a fasting blood glucose concentration exceeding or equal to 5.5 mmol/l were selected for a glucose tolerance test in the second part of the study, and were invited to present themselves at a later day. Glucose (75 g) was given orally in 250 ml of boiled water and capillary blood was taken before and 2 h after ingestion. A total of 3145 people were studied.

Criteria for diabetes

The criteria for diagnosis of diabetes mellitus were based on the suggestions made by the World Health Organization [8]: a fasting blood glucose concentration (capillary whole blood) exceeding or equal to 7.0 mmol/l, or a blood glucose value 2 h after a 75-g glucose load exceeding or equal to 11.0 mmol/l. Before the study, one patient was known to have diabetes.

Definition of body mass index

The body mass index was calculated as weight/height^2 [9]. The degree of obesity was defined by using the limit 25 (females) and 27 (males) [9].

Statistical procedures

The results concerning the prevalence of diabetes and obesity are presented for various age and sex groups in the three populations. For comparison, age and sex standardization was performed using the Mwanza town as a reference. Thus, the diabetes prevalence in various age and sex groups in Ndolage and Kahangala was adjusted to the age and sex distribution in the Mwanza population. For comparisons of distribution, χ^2 and Fishers exact tests were used.

Results

The age distribution in the three populations is shown in Table 1. About 60% of the people were aged < 20 years, whereas only 17% were aged ⩾ 40 years. Only 5% were ⩾ 60 years of age. Overall, 47% were male ($p < 0.001$). At the Ndolage villages, there were more people in the older age groups than at Kahangala or Mwanza.

Calculations (M ± SEM) of the body mass indices for the population aged > 15 years in the three populations revealed that males had indices 20.1 ± 2.6 (Ndolage), 20.6 ± 2.4 (Kahangala) and 20.3 ± 2.8 (Mwanza), and females 21.0 ± 2.8 (Ndolage), 21.3 ± 2.5 (Kahangala) and 22.5 ± 3.9 (Mwanza), respectively.

Obesity was defined as a body mass index exceeding 27 (males) or 25 (females) [9]. A total of 12 males (2%) and 111 females (16%) were obese, giving a total prevalence in the population aged ⩾ 20 years of 10%. Mwanza had a higher degree of obesity than the villages ($p < 0.01$). Thus, among males, seven (4%) in Mwanza were obese, whereas in Ndolage there were two (1%) and in Kahangala three (2%). Among females 55 (26%) were obese in Mwanza, 26 (10%) in Ndolage and 30 (13%) in Kahangala.

A total of 175 people (6%) had a fasting blood glucose value ⩾ 5.5 mmol/l. Of those were 75 (5%) males

and 100 (6%) females. In Ndolage a high value was found in 87 subjects (8%), in Kahangala in 27 (3%) and in Mwanza in 61 (6%). In all these subjects an oral glucose tolerance test was performed, showing that at Ndolage 12 (1.1%) and in Mwanza 8 (0.8%) had diabetes (Table 2). In Kahangala only two people (0.2%), females aged 35 and 70 years, had diabetes. Thus, a total of 22 diabetic patients were found, of whom only one was known before. This represents prevalence rates of 0.7% in the total population, 1.6% in the population aged ≥ 20 years, 2.9% in the population ≥ 40 years, and 4.9% in those aged ≥ 60 years. All patients denied symptoms. Of the diabetic patients, seven were male and 15 female, compared with the male : female ratio of 1 : 1.15 in the general population. In the population ≥ 20 years of age, the prevalence rates were respectively 2.5% (Ndolage), 0.5% (Kahangala) and 1.9% (Mwanza), and in the population ≥ 60 years of age respectively 4.0% (Ndolage), 2.4% (Kahangala) and 15.0% (Mwanza). Calculations revealed that Ndolage had a higher diabetes prevalence than Kahangala ($p = 0.013$ in the total population and $p = 0.017$ in the population ≥ 20 years of age), whereas no significant difference was seen between Mwanza and the rural areas. After age and sex standardization of the populations to the Mwanza distribution the diabetic prevalence was 0.8% at Ndolage and 0.2% at Kahangala (compared with 0.8% in Mwanza) in the total population ($p = 0.054$) and in the population ≥ 20 years of age respectively 1.7% at Ndolage and 0.5% at Kahangala compared with 1.9% in Mwanza ($p = 0.089$).

Two diabetic patients were obese: a female with a body mass index of 32.9 and a male with 27.0. Thus, the obesity prevalence in the diabetic patients was 9.1% compared with 3.7%.

Discussion

The clinical impression in Tanzania is that the prevalence of diabetes varies between different areas of the country and also that the prevalence is increasing. In the present epidemiological survey, we found that the two rural areas had different diabetic prevalence rates, a finding which has implications for the planning of health services in this country. The difference in diabetes prevalence between the two areas is partly explained by varying age and sex distribution. Another factor, which may be of importance for development of diabetes, is that the two tribes (Sukuma and Haya) are genetically different. In addition there are environmental differences between the areas, such as in dietary habits or physical exercise. Thus, among the Hayas the staple food is cooking banana, whereas among the Sukumas it is maize and cassava. Also, the Sukumas, who had the lower diabetic prevalence, have a higher degree of physical activity, although this is not reflected in the prevalence of obesity. Further, more subtle differences related to the different history and life style add to the differences between the two tribes, all being factors which might influence the prevalence of diabetes [1, 10].

No clear association between diabetes and obesity or sex was noted. However, the numbers of patients are insufficient to exclude an association between diabetes and obesity, and indeed it is difficult to find a good definition of obesity [9, 11]. In contrast, a strong association was seen between diabetes and age. In the age group ≥ 60 years, 4.9% had diabetes and in Mwanza the figure was 15%. None of the newly-discovered patients admitted to any symptoms relating to hyperglycaemia. All were considered to have Type 2 (non-insulin-dependent) diabetes.

Earlier studies from Africa have shown a prevalence of diabetes of between 0.2% and 0.5% in rural areas [2] and between 0.6 and 1.2% in urban areas [4, 5], calculated as the prevalence in the population ≥ 20 years of age. Studies from other tropical countries have shown varying results, ranging from a low prevalence of 1.0%–1.5% overall in the population in India to a very high prevalence in migrant Indian communities in South Africa or the Micronesian population of Nauru [1, 4, 12].

When comparing results from various studies, it is important to compare the different methods used as well as different age and sex distributions in the populations and in no earlier study from Africa has the same method as ours been used. Our figures in the present study might underestimate the real diabetic prevalence since we used fasting glucose concentration alone for screening [13]. A survey with a 2-h post load level is the most sensitive, but very difficult to organize. Also, the World Health Organization suggests that for a proper diagnosis two hyperglycaemic values are necessary. However, all our newly-discovered diabetic patients have remained diabetic during the follow-up at our diabetic clinics.

Thus, in Tanzania our study shows an overall diabetes prevalence in our three populations of 0.7% and in the population ≥ 20 years of age of 1.6%, but geographical variation exists. Although these figures appear at first sight to be relatively low, if corrected for the age distribution they would be higher than in a white community. It is, however, difficult to calculate the prevalence for the whole of Tanzania since it is populated by more than 120 tribes.

It is of special interest that none of our newly discovered patients showed any symptoms. This suggests that high blood glucose concentrations may go undetected and thus untreated for a considerable time, in turn indicating the need for more active screening in certain areas of Tanzania.

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