

## HIGH INCIDENCE OF TYPE I DIABETES MELLITUS IN SUDANESE CHILDREN, 1991-1995

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In the past few years registries of type I diabetes mellitus have rapidly proliferated worldwide as part of the WHO multinational project on childhood diabetes.<sup>1</sup> As a result, a vast amount is being learned about the epidemiology of childhood diabetes in different geographical areas, with an apparent global increase in its incidence.<sup>2-6</sup> In Africa, the epidemiology of type I diabetes was almost unknown until very recently. In 1989, we reported on the prevalence of type I diabetes in Sudanese children<sup>7</sup> and a brief communication reported on the epidemiology of juvenile diabetes in Algeria.<sup>8</sup> Based on data obtained from a type I diabetes registry, we have documented a rising incidence over a short period of time.<sup>9</sup> The present study compares the incidence of type I diabetes in children aged 0-14 years from 1991 to 1995 with the previously reported figures.

### Subjects and Methods

A hospital registry of all patients with type I diabetes was established in 1987, according to global guidelines.<sup>10</sup> Children satisfying standard criteria for diagnosis of type I diabetes were recorded prospectively. All children below the age of 15 diagnosed while living in Khartoum city, Northern Sudan, during the period from 1 January 1991 to 31 December 1995, were identified from the registry. To minimize the possibility of incomplete registration of diabetic children, the records of the Sudanese Juvenile Diabetes Society were utilized as a secondary independent source for case ascertainment. For each child identified from any one of the two sources, the following data were abstracted from his or her record: name, gender, date of birth, date of diagnosis, address and family history of diabetes.

Population figures were derived from the 1990

Khartoum state census and 1993 whole Sudan census data, with linear interpolation for the other years. According to the Sudanese National Bureau of Statistics, the number of children below the age of 15 in Khartoum city increased from one million in 1987 to 1,055,000 in 1993.<sup>11</sup>

Standard approaches for analysis that have been advocated by the WHO DIAMOND project<sup>12</sup> were used in this study. Completeness of ascertainment was estimated using the capture-recapture model, which assumes independent ascertainment of the same catchment population by two different sources.<sup>13</sup> Age-adjusted rates were calculated for the sexes separately and for the boys and girls combined, assuming equal numbers in each of the five-year classes using the direct method.<sup>14</sup> The 95% confidence intervals around these rates were determined based on the Poisson distribution.<sup>15</sup> The effect of age and gender in incidence of diabetes were tested by chi-squared statistics.<sup>16</sup> Tests for seasonal variation in incidence were carried out using the method of Walter and Elwood.<sup>17</sup>

### Results

Between 1991 and 1995, 467 children were diagnosed as having type I diabetes in Khartoum hospital and 403 diabetic children were registered in the secondary source. Of these, 351 patients appeared in both registers. Using the capture-recapture statistics to correct for under-ascertainment, the true number of diabetic children living in Khartoum during the five-year period was estimated at 534. The calculated overall degree of case ascertainment was 97%. The cases that escaped detection from the primary source were children who were not hospitalized at the onset of the disease. Table 1 shows the annual age-adjusted rates in the studied population.

The incidence of diabetes increased with age in both sexes and the highest rate was in the 10-14-year age group. The median age at diagnosis for both sexes was 11 years and there were slightly more girls than boys among the diabetic patients. However, the difference was not statistically significant. Strikingly, out of the 534 patients there were only 19 patients below the age of five years (3.5%).

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TABLE 1. Annual age-adjusted incidence rates for type I diabetes in 0-14-year-old Sudanese children, 1991-1995.

Year	Denominator	No. of cases	Male	Female	Incidence rate/ 10 <sup>5</sup> (CI)
1991	1,045,000	103	51	52	9.5 (8.1-11.7)
1992	1,050,000	106	52	54	9.8 (7.5-12.1)
1993	1,055,000	107	53	54	10.1 (8.3-12.7)
1994	1,060,000	108	53	55	10.2 (8.7-12.9)
1995	1,065,000	110	54	56	10.3 (9.0-13.2)
Total		534	263	271	10.1 (9.0-12.8)*

\*Average annual incidence.

The majority of patients (47%) were diagnosed during winter (November to February), 30% were diagnosed during autumn (July to October) and only 23% during summer (March to June). The difference was statistically significant ( $P < 0.01$ ).

### Discussion

In contrast to our previous observation of substantial increment in incidence rate between 1987 (5.9/10<sup>5</sup>) and 1990 (10.1/10<sup>5</sup>), with an average annual incidence of 7.9/10<sup>5</sup>, the present incidence rate, though higher than those figures, remained at the same level without significant fluctuations over the five-year period. However, compared to some recent reports on the incidence of type I diabetes from Africa and the Middle East,<sup>18-20</sup> our incidence figure ranks higher, approaching those quoted for Britain and France.<sup>21,22</sup> The seasonal variation in diabetes incidence shown in this study agrees with our previous observation<sup>9</sup> and is similar to several other studies in which the highest number of diabetic cases were diagnosed during the cooler months of the year, in both sides of the hemisphere.<sup>23,24</sup>

The finding that more than 10% of our diabetic children were not admitted to hospital at diagnosis is a cause for concern. Unfortunately, many physicians still prefer to manage newly discovered diabetic children at their private clinics and refer them to hospital only when they develop severe hypoglycemia or diabetic ketoacidosis (DKA). Not only does this practice render the hospital diabetics registry incomplete, but this approach is potentially dangerous to the patients, as private clinics in Khartoum lack the facilities for education and training of diabetic patients in life-saving skills. In a country where illiteracy is prevalent, patients routinely keep away from hospital until their condition is much more severe. In a previous study, we found that 81.2% of the newly diagnosed diabetic children presented to hospital with ketoacidosis.<sup>25</sup> Furthermore, we suspect that some of these children, particularly those below the age of five years, might have died at onset without being diagnosed. DKA

could easily be overlooked as cerebral malaria or meningitis in the busy emergency reception of most hospitals in Africa.<sup>26</sup> This could well underestimate the true incidence of type I childhood diabetes in Sudan and may offer an explanation for the rarity of diagnosed cases of type I diabetes before the age of five years.

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