

# High Incidence of Childhood-Onset IDDM in Kuwait

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**OBJECTIVE** — To determine the incidence of insulin-dependent diabetes mellitus (IDDM) in children aged 0–14 years in Kuwait, as part of the World Health Organization Multinational Collaborative Study (DIAMOND), and to determine if the incidence rates have increased.

**RESEARCH DESIGN AND METHODS** — All cases of IDDM diagnosed before the child's 15th birthday between 1 January 1992 and 31 December 1993 were recorded. Prospective notification of all children with newly diagnosed diabetes who were admitted to hospitals and periodic review of hospital medical records provided the primary source; notification by physicians working in diabetic clinics, in which registry of all new cases is mandatory, provided the secondary source of ascertainment.

**RESULTS** — The degree of ascertainment was 92.2%. The annual incidence of IDDM for children aged 0–14 years over the 2-year period was 15.4/100,000 (95% confidence interval, 12.4–19), with a male:female ratio of 1.2:1. The age-specific annual incidence rates for the age-groups 0–4, 5–9, and 10–14 years were 12.8, 15.1, and 18.3/100,000, respectively, with a male:female ratio of 1.45:1 in the 0- to 4-year-old age-group and an equal sex ratio in the 5- to 9- and 10- to 14-year-old age-groups. No significant difference was detected between incidence rates of IDDM in boys and girls in the three age-groups. There was no significant linear trend toward an increase in IDDM incidence rates as age advanced. Compared with a previous study by Taha et al. (Taha T, Moussa M, Rashed A, Fenech F: Diabetes mellitus in Kuwait: incidence in the first 29 years of life. *Diabetologia* 25:306–308, 1983), there was a nearly fourfold increase of IDDM in the age-group 0–14 years, mainly in those children <5 years old, suggesting a rapid increase in a short period of time.

**CONCLUSIONS** — Kuwait has the highest incidence of IDDM in children in the region, and an apparently increasing incidence has been demonstrated over the last decade.

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Received for publication 19 May 1994 and accepted in revised form 26 January 1995.

CI, confidence interval; IDDM, insulin-dependent diabetes mellitus; WHO, World Health Organization.

In many countries, the incidence of insulin-dependent diabetes mellitus (IDDM) is rising (1,2), in some cases in epidemic proportions (3). The areas demonstrating the most rapid increases are those that currently have a high incidence of the disease in Northern Europe (4) and Sardinia (5).

In Middle Eastern countries, socioeconomic developments and changes in lifestyle have been accompanied by the emergence of diabetes as a major problem, but reliable epidemiological data are still scarce and comparability is generally poor (6). Furthermore, despite its potential importance, there is little information concerning IDDM in Arab countries (7–10). The first such study was from Kuwait (7), where a relatively low incidence of IDDM in the 0- to 14-year-old age-group (3.96/100,000) was reported. This incidence was considerably lower than those reported from Europe or North America (6). However, there is a suggestion of a rapid increase of IDDM in the region as great as, if not greater than, that seen in any region of the world.

In 1992, we started a registry for IDDM in children as part of the World Health Organization (WHO) Collaborative Multinational Project (DIAMOND), and, in this study, we provide evidence of a relatively high incidence rate.

## RESEARCH DESIGN AND METHODS

Kuwait is a small oil-rich Arab country of 17,878 km<sup>2</sup>, situated in the northeastern part of the Arabian peninsula and located between latitudes 28° 45' and 30° 05' north of the equator and between 46° 30' and 48° 30' east of Greenwich (11). It is a highly urbanized, sparsely populated country with an economically affluent society. In 1993, the total population was 1,496,000 residents, of whom 43% were Kuwaitis, 49% were expatriates, and 8% were of undetermined statehood. The latter group is composed of seminomadic residents of Kuwait, who are generally more mobile and, thus, do not hold Kuwaiti citizenship.

**Table 1—Average incidence of IDDM/100,000 among children 0–14 years in Kuwait—1 January 1992 to 31 December 1993**

	n	No. diagnosed over the 2 years	Incidence rate/100,000	95% CI
<b>Ages 0–4</b>				
Boys	53,699	16	14.90	8.52–24.13
Girls	51,504	11	10.68	5.53–19.12
Total	105,203	27	12.83	8.46–18.74
<b>Ages 5–9</b>				
Boys	48,023	16	16.66	9.53–26.99
Girls	47,459	14	14.75	8.05–24.78
Total	95,482	30	15.71	10.60–22.46
<b>Ages 10–14</b>				
Boys	40,055	15	18.72	10.49–30.90
Girls	39,226	14	17.85	9.74–29.99
Total	79,281	29	18.29	12.25–26.34
<b>All ages</b>				
Boys	141,777	47	16.58	12.17–22.08
Girls	138,189	39	14.11	10.03–19.28
Total	279,966	86	15.36	12.36–19.06

The state, recognizing the increasing prevalence of diabetes and its emergence as a health problem, set up 14 diabetic clinics throughout the country. For patients to receive treatment, which is provided free of charge, they must register in one of the diabetic clinics.

The registry was started in 1992 as part of the WHO DIAMOND Project. At the time, the number of Kuwaiti children <15 years old was 279,966, of whom 141,777 were boys and 138,189 were girls, and this group constitutes the target population studied.

Prospective notification of children with newly diagnosed IDDM admitted to hospitals, government or private, and periodic review every 3 months of hospital medical records by two of the authors (A.A.S., M.A.Q.) provided the primary source of ascertainment. Notification by pediatricians and physicians in the diabetic clinics constituted the secondary source of ascertainment. Each notification included demographic data (and civil identification number), collected according to a standard protocol provided by the WHO Collaborating Centre in Pittsburgh, PA, to ensure com-

parability. Diagnosis of IDDM was made according to accepted criteria (12), in addition to the presence of ketonuria and requirement for insulin to attain growth and avoid ketoacidosis. The assessment of completeness of ascertainment was based on the capture-recapture method, which assumes independent ascertainment of the same catchment population by two alternative sources.

Ascertainment probability (percentage) was calculated using  $a(a + b + c)/(a + c)(b + a)$ , where  $a$  is the number of cases found by either source,  $b$  is the number found by the secondary source only, and  $c$  is the number found by the primary source only (13).

Age- and sex-specific incidence rates were calculated from the numbers of new cases observed divided by the number of person-years at risk in each of the age-groups, 0–4, 5–9, and 10–14 years, for each sex. The numbers of cases of IDDM in the 2 years, 1992 and 1993, have been used to stabilize calculated incidence rates. The denominator was provided by the Public Authority of Civil Information for the year 1993. The 95% confidence intervals (CIs) of incidence

rates were computed based on Poisson distribution (14). The chi-squared test for linear trend (15) was used to assess the significance of trend in IDDM incidence rates as age increased. The normal Z test was used to test the difference between incidence rates of IDDM in boys and girls.

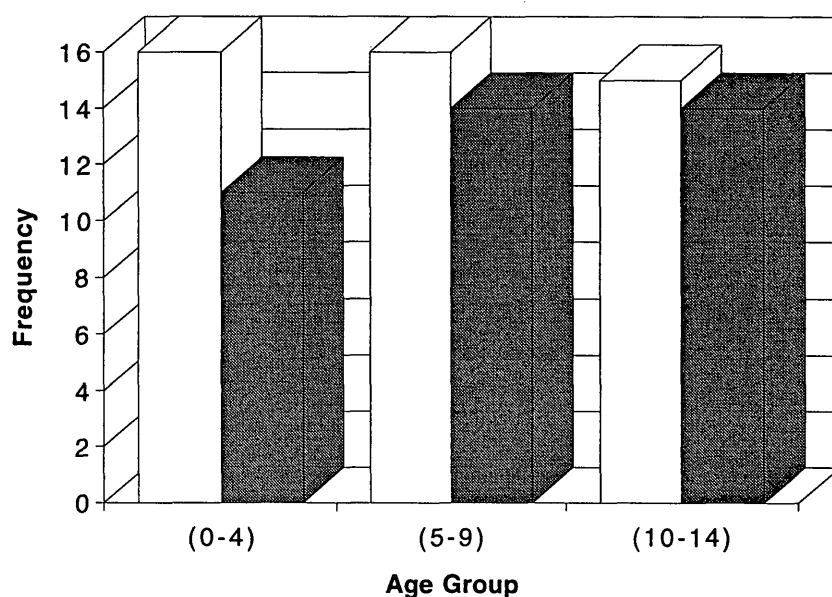
**RESULTS**—A total of 112 children <15 years old met the diagnostic criteria for IDDM. They were identified during the period between 1 January 1992 and 31 December 1993. Of these 112 children, 86 were Kuwaiti children and 26 were resident non-Kuwaiti children of undetermined citizenship, who were excluded from the study because a reliable denominator is not available.

Of the remaining 86 children, 32 were identified through the primary source only, 10 were identified through the secondary source only, and the remainder (44) were identified through both sources, providing a degree of ascertainment of 92.2%. (95% CI, 90.5–93.9%). Of the children, 27 (31%) were aged 0–4 years, 30 (35%) were aged 5–10 years, and 29 (33%) were aged 10–14 years, with age-specific incidence rates of 12.8, 15.7, and 18.3/100,000, respectively (Table 1). The average annual incidence rate in the age-group 0–14 years was 15.4/100,000 (95% CI, 12.4–19).

### Sex ratio

There was a slight male preponderance in all age-groups (Fig. 1), although this difference was not statistically significant in the three age-groups studied (chi-squared,  $P = 0.508$ ,  $0.881$ , and  $0.955$  for the age-groups 0–4, 5–9, and 10–14 years, respectively). When considered separately, in 1992, boys predominated in children <5 years of age, while girls predominated in the older age-groups. However, in 1993, boys predominated in the age-groups 5–9 and 10–14 years (data not shown).

In addition, there was no significant linear trend toward an increase in incidence rate as age advanced (chi-squared for trend,  $P = 0.183$ ; odds ratios



**Figure 1**—Sex distribution of Kuwaiti children with IDDM diagnosed between 1 January 1992 and 31 December 1993. □, boys; ■, girls.

1, 1.22, and 1.43 for the age-groups 0–4, 5–9, and 10–14 years, respectively) or when separated into boys and girls ( $P = 0.524$  and  $0.199$  in boys and girls, respectively).

**CONCLUSIONS**— In this study, the annual incidence rate (per 100,000) of IDDM in Kuwait was 15.4 (95% CI, 12.4–19) for children aged 0–14 years, and the age-specific annual incidence rates for the age-groups 0–4, 5–9, and 10–14 years were 12.8, 15.1, and 18.3/100,000, respectively. The first report on incidence of diabetes in the region came from Kuwait (7) and demonstrated a very low incidence of IDDM in the age-groups 0–14 and 0–19 years (4.0 and 5.6/100,000, respectively). During 1980–1981, 22 children <15 years old with IDDM were identified (7), compared with 86 children in this study. The age-specific incidence rates were 1.4 and 5.6 in the age-groups 0–4 and 5–14 years (Table 2), an almost fourfold increase in incidence in children <15 years of age and a ninefold increase in incidence in children <5 years of age (12.8. vs. 1.4/100,000). This large incidence in children <5 years of age may

represent a major change in incidence of diabetes in this region and must be studied further.

However, two important facts must be noted: first, the methodology in the previous study by Taha et al. (7) differed from ours in that cases were identified by one source only; and secondly, a method of ascertainment was not used. On the other hand, it may be suggested that overascertainment may explain the

high incidence rate found in our study. This, however, is not possible, as each case has a unique civil identification number, which was entered in the computerized files to avoid any double counting of the same case. The male:female ratio of 1.2:1 in the 0- to 14-year-old age-group (Fig. 1) is consistent with those reported from other countries (1,16–18).

A comparison with recently available incidence rates from other Arab countries shows that the incidence in Kuwait appears to be the highest in the region (Table 3). In 1990, the annual incidence rate for Libyan children in the age-group 0–14 years was 10.1/100,000, compared with an incidence of 3.8/100,000 in the same age-group in 1981 (19), and is similar to our results.

It is interesting that the incidence rates in Kuwait are as high as those seen in some European countries, namely Malta (13.6/100,000) (20) and Spain (10.9/100,000) (1). Thus, IDDM is not rare in Arab populations.

Although our study did not address etiological factors, one can speculate on the cause of this high incidence. Factors that may play a role in  $\beta$ -cell damage include viral infections, environmental toxins, insufficient nutrition, and stress factors (21). The role of stress factors cannot be ignored. In 1990, Kuwait

**Table 2**—Annual incidence rates of IDDM among children 0–14 years of age in the years 1980–1981 and 1992–1993 in Kuwait

	Age group		
	0–4 years	5–14 years	0–14 years
1980–1981			
Boys	0.91	4.69	3.20
Girls	1.87	6.56	4.73
Total	1.38	5.61	3.96
1992–1993			
Boys	14.9	17.69	16.58
Girls	10.68	16.35	14.11
Total	12.83	17.00	15.36

Data for 1981–1982 are from Taha et al. (7). Data for 1992–1993 are from this study.

**Table 3—Annual incidence rate per 100,000 of childhood-onset IDDM in Kuwait compared with recent data from similar countries in the region**

Country	Study period	Incidence/100,000	Reference
Algeria (Oran)	1980–1989	8.1	1
Libya	1990	10.1	19
Sudan	1990	10.1	9
Kuwait	1980–1981	4.0	7
	1992–1993	15.4	This study
Malta	1980–1987	13.6	20
Spain (Catalonia)	1989–1990	10.6	1

was subjected to aggression, which induced considerable stress in adults and children living both in and outside Kuwait. Risk factors, such as stressful life events, which may increase the peripheral need for insulin, may not only act as promoters of  $\beta$ -cell destruction, but may also disclose the  $\beta$ -cell impairment and make the disease clinically overt (22). On the other hand, the very rapid economic changes and affluence in Kuwait and the Gulf region may have affected certain traditions and practices, such as breastfeeding. These possible etiologies require further elucidation.

In conclusion, a relatively high incidence of IDDM has been demonstrated in Kuwait, and it does not support a south-to-north incidence gradient. In addition, an apparent increasing incidence has been observed. Thus, an adequate information system is an essential part of any diabetes control strategy and in the documentation of whether these high incidence rates will persist. Furthermore, the younger age structure and high incidence of IDDM in the very young will have a great impact on health provision policies and in estimating the actual direct and indirect costs of IDDM for the individual and society and the needs of society in terms of specific treatment and education.

**Acknowledgments**—This work was supported by Research Grant MDK 268 from Kuwait University.

The authors thank Dr. M. Al Ayad, area director of the Capital Health Area, Kuwait, for his support; all of the physicians in the diabetes clinics who reported the cases to the investigators and without whom this work could not have been possible; departmental secretaries and medical records officers who facilitated the work of the investigators; Racha Omar, research assistant, Kuwait Institute for Scientific Research; and Randa Abdul Salam for computer data entry and analysis. The authors also thank Prof. Allie Moosa for comments and helpful criticism and Elizabeth D'Couto and Martha Norohna for excellent secretarial assistance.

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