Prevalence of type 1 diabetes mellitus in Saudi Arabian children and adolescents

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ABSTRACT

الأهداف: تحديد نسبة حدوث النوع الأول من السكر عند الأطفال واليافعين السعوديين (0–19) عاما.

الطريقة: تم إجراء مشروع سعودي وطني بين عامي 2001م – 2007م، بهدف تحديد معايير النمو الطبيعية ونسبة حدوث بعض الأمراض المزمنة مثل السكر. تم اختبار 1400 منزلاً بطريقة عشوائية مبنية على إحصاء حديث، وتم تحديد نسبة الحدوث والتي عُبر عنها بعدد الحالات لكل 100.000 نسمة، وكذلك بناءًا على العمر والمنطقة الجغرافية.

النتائج: أجري مسح 45682 طفلاً ويافعاً من 11874 منزلاً عينت إحصائيا. تم ملاحظة وجود 50 طفلاً ويافعاً مصاباً بالنوع الأول من السكر، لتصبح نسبة الحدوث 109.5 لكل 100.000 نسمة. كانت نسبة الذكور للإناث متساوياً على وجه التقريب (26 ذكراً – 24 أنثى). عند دراسة نسبة حدوث السكر بناء على المنطقة الجغرافية وجد أنه أعلى منطقة هي المنطقة الوسطى (162 حالة)، وأقل منطقة هي المنطقة الشرقية (48 حالة), كما تم تصنيف العينة حسب العمر 5–6، 7–12، 13–16، 17–18 سنة، حيث حُددت نسبة الحدوث بـ 100، 109، 243، و150 حسب الترتيب.

خاتمة: تبين إن نسبة حدوث النوع الأول من السكر في المملكة العربية السعودية هي 109.5 لكل 100.000 نسمة.

Objective: To determine the prevalence of type 1 diabetes mellitus among 0-19 years old Saudi children and adolescents.

Methods: A nationwide Saudi Arabian project was conducted in the years 2001-2007 with the objective of establishing national growth charts, and defining the prevalence of some chronic childhood diseases such as diabetes mellitus. The 14,000 households were randomly selected based on a recent population statistic. The questionnaire used included demographic data and evidence of diabetes mellitus. The prevalence was estimated and expressed per 100,000. Breakdown of this figure per age and region was carried out.

Results: In the 11,874 out of the 14,000 (84.9%) selected households, 45,682 children and adolescents were surveyed. Fifty children and adolescents were identified to have type 1 diabetes mellitus with a prevalence rate of 109.5 per 100,000. The male to female ratio was almost equal (26 males and 24 females). The distribution of prevalence of type 1 diabetes mellitus by region shows that the highest was 162 in the central region, and the lowest was 48 in the eastern region. Children and adolescents were also grouped by age into 5-6 (prevalence 100), 7-12 (prevalence 109), 13-16 (prevalence 243), and 17-18 (prevalence 150).

Conclusion: We conclude that the prevalence of type 1 diabetes mellitus in Saudi Arabian children and adolescents is 109.5 per 100,000.

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Diabetes Mellitus (DM) has become the most common non-communicable chronic metabolic disease worldwide.[1] The frequency is projected to reach 285,000,000 in the year 2025.[2] This is not only true for type 2 DM likewise also for type 1 DM. Type 1 DM may have witnessed a 400 fold rise in the recent years.[3,4] Incidence and prevalence may differ from one country to another. There is a clear epidemiological evidence that the incidence is high in many Arab countries particularly in the gulf areas, which have been classified in the very high, and intermediate category of the Diamonds

World Health Organization study classification.[3,4] In Saudi Arabia, there have been limited epidemiological studies describing the prevalence of DM. Most of these studies were either hospital based or carried out on all types of DM.[5-16] The aim of this study is to estimate the prevalence of type 1 DM in Saudi Arabian children and adolescents (0-19 years of age), based on a random community based representative sample of the Saudi population.

Methods. A nationwide Saudi Arabian project was conducted in the years 2001-2007. Health profile of Saudi Arabian children and adolescents was studied in a project approved and funded by King Abdul-Aziz City for Science and Technology, Riyadh, Kingdom of Saudi Arabia. Among the aims of the project was to study the prevalence of childhood chronic illnesses such as DM. The study was a cross-sectional with randomly, selected sample using the stratified multi-stage procedure representing the 13 health regions of the Kingdom of Saudi Arabia. This was based on the Saudi national census performed in 1992, and updated in 2001. Accordingly, a sample size of a minimum of 42,000 children and adolescents from birth to 19 years of age, was felt to produce valid and representative results. Based on a presumptive family size of 2 parents and 3 children, 14,000 households were aimed. A pilot study was performed on 70 households in one of the selected cities namely, Buraida to test the questionnaire, and modify and solve the difficulties faced. Households were visited by a trained team to fill up a questionnaire, which included the demographic and medical background of all family members. Type 1 DM is a self-evident disease, which explores itself by the classical acute symptoms, and the obvious treatment consisting of insulin daily injections, known and administered by parents who were the focus recipients of the questionnaire. It was therefore, easy to document the presence of the disease in the targeted family members and therefore a supported medical report was rarely required. Inclusion criteria of the study include children and adolescents, 0-19 years of Saudi nationality who have declared evidence of this disease. Prevalence of type 1 DM was estimated by simply counting the number of affected children and adolescents during the study, divided by the sample size as a denominator. This was then expressed per 100,000.

Results. In the 11,874 out of the 14,000 selected households, 45,682 children and adolescents, were surveyed. Although the number of eligible households was less than the targeted number (eligibility was not achieved in the remaining 2,126 due to vacancy of the households, occupancy by non Saudi families, lack of eligible children, and adolescents, or rarely refusal), yet the number of children and adolescents was higher than the targeted number of 42,000. This was due to the larger family size than the proposed number. Eight thousand and six hundred eighty-nine of the 11,874 households (73%) were urban and the remaining 27% were rural. The highest level of education of the household heads was university 16.3%, secondary or intermediate 34.6%, elementary 26.1%, illiterates 19.7%, and others 3.3% in the available data of 8,340 households. The pattern of occupation of the households head was in administrations (30%), military (21.7%), private business (19%), other occupations (13.5%), unemployed (3.2%), and retired (11.6%). Consanguinity was observed in 3,882 families (33.6%) as first degree, and in a further 2,588 (22.4%) as other degrees. Feeding and nutrition data were obtained from 5,339 children who were younger than 3 years of age. Four thousand and eight hundred eighty-nine (91.6%) were breast-fed, and 480 (8.4%) were solely bottle fed. Bottle feeding was however introduced early in life (1-2 months of age) for those who were breast-fed on a relatively high percentage in 52%. Whole cow's milk was started in infants less than 6 months of age in 18.4%, and in 6 to 12 months of age in 21.4%. **Table 1** shows

Table 1 - Total number of children and adolescents.

Name of the Region	Total n (%)
Makkah Al Mokarramah	8,390 (18)
Riyadh	8,383 (18)
Eastern Province	4,420 (10)
Aseer	3,500 (8)
Al Jouf	2,822 (6)
Al Gassim	2,811 (6)
Gizan	2,679 (6)
Najran	2,337 (5)
Al Madinah Al Monawarah	2,321 (5)
Northern Borders	2,224 (5)
Hail	2,119 (5)
Al Baha	1,882 (4)
Tabuk	1,794 (4)
Total	**45,682 (100)**

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Table 2 - Prevalence of type 1 diabetes mellitus by area.

Areas	No. of cases			Sample size	Prevalence per 100,000
	Males	Females	Total		
Central	6	12	18	11,098	126
Western	11	1	12	10,564	114
Eastern	2	0	2	4,160	48
Northern	2	3	5	8,856	56
Southern	5	8	13	10,262	127
Total	**26**	**24**	**50**	**45,682**	**109.5**

Table 3 - Prevalence of type 1 diabetes mellitus by age.

Age Group	No. of cases	Sample size	Prevalence per 100,000
5-6	5	4,996	100
7-12	17	15,614	109
13-16	23	9,465	243
17-18	5	3,361	150
Total	**50**	**33,436**	**150**

the distribution of the study sample per each region of the Kingdom of Saudi Arabia. The figure of the total number in all regions was used as the denominator for the calculation of prevalence of type 1 DM. Fifty children and adolescents were identified to have type 1 DM with a prevalence rate of 109.5 per 100,000. The male to female ratio was almost equal (26 males and 24 females). The distribution of prevalence of type 1 DM by various areas of Saudi Arabia is shown in **Table 2**. The highest was in the central area, and the lowest was in the eastern area. **Table 3** shows the prevalence of type 1 DM by age.

Discussion. The international projections of the rapid increase in the incidence and prevalence of both types of diabetes, are becoming true.[2,17] For instance, 4 Arab Gulf countries are among the 5 countries with the highest diabetes prevalence in adults following Nauru.[17] The International Diabetes Federation in a recent statement, further stated that the largest increase in DM prevalence will take place in developing countries.[17] It has therefore become important to conduct epidemiological studies to define either the incidence, like the number of cases of DM having their onset during a prescribed period of time, or the prevalence, like the number of DM cases that are present in a particular population at a given time. The former is usually achieved if there is a national registry which recently started in Saudi Arabia, and the latter is achieved by cross-sectional field epidemiological studies like the present study. Incidence and prevalence of type 1 DM are in the rise at both the international and local levels. Figures reported from the Middle East (2.62-20.18) show that the incidence of type 1 DM was very much comparable to the high North American (7.61-25.7) figures, compared to the other parts of the world.[18] The estimated prevalence of type 1 DM is also increasing compared to the various years (1995, 2002, and 2010) and Saudi Arabia is among the listed countries.[19] Elamin et al[20] documented rising incidence over a few years in Sudan among 0-14 years old children. In Kuwait, Moussa et al[21] determined the prevalence of type 1 DM among 6-18 years old Kuwaiti children to be 269.9 per 100,000. Local national studies conducted in the last 3-4 decades showed variable figures. These studies were either community or hospital based. In 1985 Fonseca et al[12] estimated the prevalence of type 1 DM among 200 studied diabetic patients to be 3.14. This figure was found to be 11.7% in a larger cohort of diabetics in the same institution[13] Kulyalat and Narchi,[11] in the Eastern Province of Saudi Arabia, showed an increase in the incidence of type 1 DM in the year 1997 compared to the year 1986. In 1996, El Hazmi et al[14] in a larger series of more than 23,000 subjects reported prevalence rate of type 1 DM to be 0.017% in younger than 14 years old 8,000 children.

In the present study, the figure of 109.5 per 100,000 is the prevalence, and not the incidence. It is based on the randomly selected sample of the whole community for Saudi children and adolescents from birth to 19 years of age. Furthermore, this figure does not include type 1 DM in adults. We therefore strongly believe that the present study is the first of its kind to determine the true prevalence of type 1 DM in the Saudi community younger than 20 years based on a representative sample at the beginning of the 21st century. In comparing this prevalence to the reported Kuwaiti prevalence, it is important to know that in the Kuwaiti series, the sample was 6-18 years of age children and adolescents. Further, analysis of our data showed that the youngest child reported was 5 years of age. It may therefore be possible to have comparable figure to Kuwait if the number of this age group, namely, 5-18 years children and adolescents are taken as a denominator.[21] Performing epidemiological studies on a periodic basis is not only important for establishing the data base or making a historic landmark for future comparison, however, it is important in tracing a possible related etiological factor. The fact that prevalence in this series is more on certain age groups namely 13-16 years and in certain areas, and central area, may give an etiological hint, which may unravel itself in the future. This is augmented by the already active studies looking at the genetic as well as the environmental and immunological factors.[22]

Type 1 DM has no permanent cure at the present time, yet defining the magnitude of the problem in the community is very important in order to plan education

and prevent complications in joint community efforts.[23,24] Regardless of the educational background of parents explored in this study, subjecting the whole family to intensive education of techniques and dietary knowledge with constant reinforcement is even more important. Many possible contributing environmental factors have been addressed trying to define a predictive factor to development of type 1 DM. Prominent example perhaps is the early introduction of cows milk or other food. Long term prospective studies however failed to prove clear cause and effect relationship.[25] Certainly, the present series showed a relatively high rate of early introduction of formulas and other kinds of cow's milk. It is also hard to consider any cause and effect evidence of this disease with the presented figure of consanguinity, which may not be very much different from the overall consanguinity in the community.[26]

In conclusion, the present study establishes the prevalence of type 1 DM among Saudi children and adolescents to be 109.5 per 100,000. This study has a limitation of not showing the incidence, which is usually evident if the registry program succeeds in its national annual data. This study has not also looked at the various possible etiological factors, which will be hypothetical at any rate. We suggest to repeat such study on periodic basis, and perhaps connect these national projects to both national and international epidemiological studies.

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