Epidemiological profile of type 1 diabetes among primary school children in Baghdad, Iraq

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Objectives   To estimate the prevalence of type 1 diabetes mellitus in primary school children in Baghdad City, and to evaluate its effect on growth of those children.

Methods   This comparative cross-sectional study was conducted in a sample of primary schools in Baghdad city selected by multistage cluster sampling. All primary school students in the selected schools were included. For every diabetic child, we selected a child from the same class who is free from diabetes. Information on disease variables were obtained through sending questionnaire to the children's parents. The Centers for Disease Control and Prevention growth charts were used.

Results   The total number of primary school students in the selected 141 schools was 69,115; 110 of them had T1DM (159/100,000). Female to male ratio was 1.3:1. Obesity and underweight were significantly lower in diabetics than non-diabetic children (P=0.03).

Conclusion   The prevalence of type 1 diabetes mellitus was 159 per 100,000, which was approximate to the prevalence in Saudi Arabia, less than that in Al-Kuwait, but higher than that in Turkey. Percentage of underweight and obesity were lower in the diabetics while overweight percentage was slightly higher compared to the non-diabetics.

Keywords   type 1 diabetes, primary school children, prevalence, obesity, underweight

Introduction

Type 1 diabetes mellitus (T1DM) is one of the most common chronic diseases of childhood.[1] Its incidence is rising worldwide,[2] with reported increases of 2–5 percent per year in the Middle East.[3] In Iraq, the incidence of T1DM in Basra City is 5–9.99/100,000 per year and was increasing between 2012 and 2016.[4] Similarly, in Al-Nassiryah City the incidence was also increasing in the last 5 years,[5] and with the existence of only a few national/regional diabetes registries available to support diabetes research, provide reliable data, and help cope with the widespread threat of this disease, there is a need for establishing a population-based Arab diabetes registry.[6] Most children with T1DM grow normally, however, poor glycemic control can result in poor linear growth, poor weight gain, and/or delayed skeletal development. Conversely, treatment with excessive insulin and/or excessive caloric intake can lead to excessive weight gain. And if obesity develops, this can lead to insulin resistance, which complicates diabetes management.[7]

Purpose of the Study

To estimate the prevalence of T1DM in primary school children in Baghdad City, and to evaluate its effect on growth of those children.

Material and Methods

This is a comparative cross-sectional study that was conducted in primary schools in catchment area of 12 primary health care centers (PHCCs) in Al-Karkh side of Baghdad City, selected by multistage cluster sampling (Fig. 1), during the period of Feb 15, 2018–May 1, 2018. The study population included all primary school students in the selected PHCCs (all T1DM students in these schools and an equal number of children
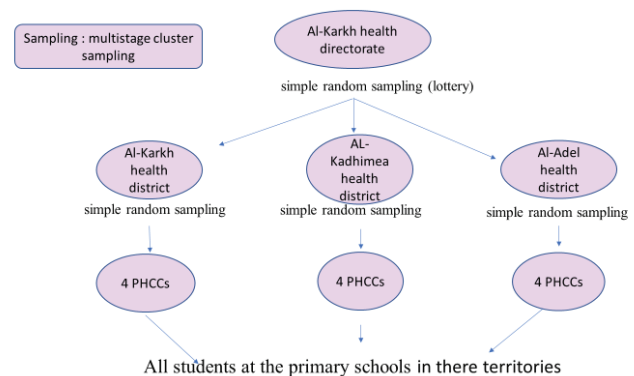

Fig. 1   **Multistage cluster sampling.**

from the same class and same gender who were T1DM-free were included). Research was done in Al-Karkh side of Baghdad/Iraq in 141 school in the territory of the following PHCCs: Name of PHCCs: Number of schools which covered by local PHCC: (Al Khadhraa PHCC: 8, Al Jamieaa PHCC: 17, The martyr Saif Zakie PHCC: 16, Al Gazalia the first PHCC: 8, Al Dakhilia PHCC: 17, Al Mansoor exemplary PHCC: 14, Martyrs of Alchalijia PHCC: 4, Al Yarmouk PHCC: 13, Al Huriya exemplary PHCC: 12, Al Jawadin exemplary PHCC: 9, Al Zahraa exemplary PHCC: 7, The new Iraq PHCC: 16). School children with any other chronic disease or comorbidities were excluded from the anthropometric measures only.

Data Collection Tools

Two different types of questionnaires had been used. The first questionnaire was filled by the researcher through direct interview with the primary school teachers. It included questions to gather information on certain student variables, and the anthropometrics' measures; the Centers for Disease Control

and Prevention (CDC) growth charts were used.[8] The second questionnaire is translated to Arabic language and was sent to parents of the diabetic group only, to gather information about disease variables: *Clinical presentation for DM* (classic new onset of chronic polydipsia, polyuria, and weight loss); diabetic ketoacidosis; or asymptomatic incidental discovery,[9] *the duration of DM* in year(s), *the age at onset of diabetes* (early onset diabetes has been variously defined as occurring anywhere from age 4 to age 7 years,[10] *blood glucose monitoring* (less than four, four, or more than four times per day) and whether a glucometer in the house was available or not, *family history* of T1DM, *the no. of follow up visit(s)* for PHCC, Diabetic center or private doctor in the last 6 months (routine follow-up should be performed at least four times a year,[11] number of ER visits and hospital admission in the last 6 months, and the value of the *last HbA1C test* for each child were all inquired. The statistical software (Statistical Package for the Social Science, release 11.0 for Windows; SPSS; Chicago, IL) was used for data entry and analysis. Descriptive statistics were used to summarize subject characteristics and questionnaire results. Chi-square test of independence was used to test qualitative and frequency data. P-value of <0.05 was considered significant. A written informed consent was obtained from parents of each enrolled student. All personal information was kept anonymous. Administrative approval was granted from research committee in Ministry of Health, Iraq.

Result

The total number of primary school students in the selected 141 schools was 69,115; 110 of them had T1DM. The highest prevalence of diabetes was in Al Mansoor exemplary PHCC (338 per 100,000) while the overall prevalence of diabetes was 159 per 100,000. The proportion of female was slightly more than male with female to male ratio of 1.3:1, diabetics' age ranged 6–14 years old. The distribution of the diabetics according to age, sex, and disease variables is shown in Table 1. The distribution of the study group according to anthropometric measures is shown in Table 2.

Table 1.

Variables	No. (n=105)	Percentage (%)
Age (year)		
6-8	23	21.9
9-11	56	53.3
≥12	26	24.8
Sex		
male	46	43.8
female	59	56.2
Clinical presentation for DM		
Classic new onset	52	62.7
Diabetic ketoacidosis	15	18.1
incidental discovery	16	19.2
Duration of DM (years)		
<3	44	53.0
3-6	30	36.2
≥7	9	10.8
Age at onset of diabetes (years)		
<7	53	63.9
≥7	30	36.1
The availability of glucometer in the house		
Yes	73	88.0
no	10	12.0
Blood glucose monitoring (No. of times per day)		
<4	56	67.5
≥4	27	32.5

Table 2. **Distribution of study group by anthropometric measures.**

Variable	Diabetics		Nondiabetics		Chi square	P value
BMI percentile	No.(n=102)	Percentage (%)	No.(n=105)	Percentage (%)		
<5	2	**2.0**	9	**8.6**		
≥5 and <85	76	74.5	66	62.9	8.929	**0.030**
≥85 and<95	17	16.6	14	13.3		
≥95	7	**6.9**	16	**15.2**		
Weight for age percentile						
<5	5	4.9	2	1.9		
≥5 and ≤ 95	91	89.2	91	86.7	3.243	0.198
> 95	6	5.9	12	11.4		
Height for age (percentile)						
<5	10	9.8	2	1.9		
≥5 and ≤ 95	89	87.2	100	95.2	5.931	0.052
> 95	3	3.0	3	2.9		

The majority of patients (62.7%) were diagnosed by classic symptoms of diabetes. The mean for duration of DM was 3.9 ±2.4 (SD) years and 63.9% have DM before the age of 7 years. Around 10% of children didn't have follow-up visit at all, 50% of them had at least one hospital admission and frequent attacks of hypoglycemia in the last 6 months. Only 1 of them had documented HbA1c value which was 13%. Among the reminder 90% whom had gone for follow-up visit, 14.5% had 1 visit, 13.3% had 2 visits and 62.6% had >2 visits per 6 months. According to where they went for follow-up, 75.9% visited a private doctor and only 54.2% of children had documented HbA1c result.

Discussion

The prevalence of T1DM has been reported to vary greatly among different countries, within countries, and among different ethnic populations.[12] Recently, a study reported that the prevalence and incidence of T1DM were found to be variable among the Arabs.[6] This study showed that prevalence of diabetes in primary school children in Baghdad was 159 per 100,000, which was higher than Basrah where prevalence rate was 87 per 100,000,[4] despite the age group sample was much wider than this study (all ≤40 years old), but these findings were based on a retrospective data analysis of electronic archives for patients with T1DM registered in Faiha Specialized Diabetes, Endocrine, and Metabolism Center, which is a tertiary referring Center in Basrah. The prevalence of T1DM was 269.9 per 100,000 among 6–18-year-old Kuwaiti children,[13] while it was 109 per 100,000 in Saudi Arabian children (7–12 years old)[14] which is approximate to our results. Lower prevalence found in children who lived in the Nile Delta region of Egypt (26.8 per 100,000)[15] and school children living in Istanbul, Turkey, (67 per 100,000).[16] These variations might be due to the variation in the incidence of T1DM as it varied based upon geography, age, gender, family history, and ethnicity.[7] When people relocate from a region of low to high incidence, their risk of developing T1DM also increases, suggesting a causative role for environmental factor(s). However, wide variations in incidence occur between neighboring areas of similar latitude, suggesting the presence of other contributing risk factors and demonstrating the complexity of the pathogenesis of T1DM.[7] A study found that there is considerable variation among Arab countries, which could not be explained on genetic or climatic variations alone, other environmental factors particularly nutritional ones including high intake of dairy products and vitamin D deficiency are possibly operating.[17] The proportion of female was slightly more than male, which agreed with two studies as prevalence for T1DM slightly favors females in Australia,[18] and Japan,[19] but disagree with another study which slightly favors males in the USA,[20] and it was near parity in North-West England.[21] The lifetime risk of developing T1DM is significantly increased in close relatives of a patient with T1DM.[22] In this study, around 30.1% of diabetics had family history of T1DM (aunts and uncles were included), as they found that 10%–20% of newly diagnosed childhood cases of T1DM have an affected first-degree relative,[2] and familial history was more than 20% when accounting for the extended family history.[23] The higher percentage of underweight in the non-diabetics group might be due to the primary cause of poor weight gain in school-aged children and adolescents which is inadequate dietary intake relative to typical metabolic and growth needs.[24] Children may ingest too much juice or other non-nutritious liquid, resulting in satiation and decreased appetite for higher caloric density or more nutritious solid foods,[25, 26] while these beverages might be more restricted in the diabetics, and these results is approximate to Turkish study as they found that rates of overweight and obesity were 21.2% and 14.6% (35.8% combined), using the WHO growth curve,[27] compared to 13.3% and 15.2% (28.5% combined) in this study. About 2% of diabetics were underweight, 74% normal, 16.6% overweight and 6.9% obese, which agreed with a Canadian study as they found that Children with T1DM are more overweight, but not more obese.[28] An Australasian study showed that the prevalence of being overweight was 19% and of obesity was 6%,[29] and another study where none of the study subjects were underweight, 69% were within the normal weight range.[30] The challenges for maintaining healthy weight associated with T1DM include weight gain as the result of supra-physiological insulin doses, and overeating to avoid or treat hypoglycemia.[29] Another study showed that pre- and post-onset body mass index in children with T1DM were both well above the population mean, were closely correlated with each other and (inversely) with age at onset.[31] Proper attention to diet is a major factor in minimizing hypoglycemia and weight gain while achieving glycemic control.[32] The majority of patients were diagnosed by classic symptoms of diabetes which agreed with another Iraqi study.[33] Although routine follow-up should be performed at least four times a year,[11] about 10% of parents didn't go for follow-up visit at all, 50% of those had at least one hospital admission and frequent attacks of hypoglycemia in the last 6 months and only 1 of them had documented HbA1c value which was 13%. Cardwell et al found that patients attending less than four diabetes clinics in the last year had a significantly higher HbA1c level compared to those attending exactly four clinics level.[34]

Acknowledgments

Conflicts of Interest Disclosure:

None

References

1. Levitsky LL, Misra M, Wolfsdorf J, Hoppin A. Management of type 1 diabetes mellitus in children and adolescents. Complications and screening in children and adolescents with type. 2011;1.

2. Tuomilehto J. The emerging global epidemic of type 1 diabetes. Curr. Diab. Rep. 2013;13(6):795-804.

3. Mamoulakis D, Galanakis E, Bicouvarakis S, Paraskakis E, Sbyrakis S. Epidemiology of childhood type I diabetes in Crete, 1990–2001. Acta Paediatr. 2003;92(6):737-9.

4. Almahfoodh D, Alabbood M, Alali A, Mansour A. Epidemiology of type 1 diabetes mellitus in Basrah, Southern Iraq: A retrospective study. Diab. Res. Clin. Pract. 2017;133:104-8.

5. AL-Rubaee RJ. Newly diagnosed type 1 Diabetes Mellitus in Dhi-qar city (IRAQ) sociodemographic study.

6. Zayed H, Ouhtit A, El Bekay R. An Arab registry for type 1 diabetes: global benefits for type 1 diabetes patients. Curr. Med. Res. Opin. 2016;32(10):1681-4.

7. Levitsky LL, Misra M, Wolfsdorf J, Hoppin A. Complications and screening in children and adolescents with type 1 diabetes mellitus. Up To Date. 2007;17(1).

8. Phillips SM, Shulman RJ, Motil K. Measurement of growth in children. UpToDate, Basow, DS (ed), UpToDate, Waltham, MA. 2011.

9. Levitsky LL, Misra M. Epidemiology, presentation, and diagnosis of type 1 diabetes mellitus in children and adolescents. UpToDate Waltham, MA: UpToDate. 2007.

10. Ack M, Miller I, Weil WB. Intelligence of children with diabetes mellitus. Pediatrics. 1961;28(5):764-70.

11. Chiang JL, Kirkman MS, Laffel LM, Peters AL. Type 1 diabetes through the life span: a position statement of the American Diabetes Association. Diab. Care. 2014;37(7):2034-54.

12. Dabelea D. The accelerating epidemic of childhood diabetes. Lancet. 2009;373(9680):1999-2000.

13. Moussa MA, Alsaeid M, Abdella N, Refai TM, Al-Sheikh N, Gomez JE. Prevalence of type 1 diabetes among 6-to 18-year-old Kuwaiti children. Med. Princip. Pract. 2005;14(2):87-91.

14. Al-Herbish AS, El-Mouzan MI, Al-Salloum AA, Al-Qurachi MM, Al-Omar AA. Prevalence of type 1 diabetes mellitus in Saudi Arabian children and adolescents. Saudi Med. J. 2008;29(9):1285-8.

15. El-Ziny MAE-M, Salem NA-B, El-Hawary AK, Chalaby NM, Elsharkawy AA-E. Epidemiology of childhood type 1 diabetes mellitus in Nile Delta, northern Egypt-a retrospective study. J. Clin. Res. Pediatr. Endocrinol. 2014;6(1):9.

16. Akesen E, Turan S, Güran T, Atay Z, Save D, Bereket A. Prevalence of type 1 diabetes mellitus in 6–18-yr-old school children living in Istanbul, Turkey. Pediatr. Diab. 2011;12(6):567-71.

17. Abdullah MA. Epidemiology of type I diabetes mellitus among Arab children. Saudi Med. J. 2005;26(6):911-7.

18. Speight J, Browne JL, Holmes-Truscott E, Hendrieckx C, Pouwer F. Diabetes MILES-Australia (Management and Impact for Long-term Empowerment and Success): methods and sample characteristics of a national survey of the psychological aspects of living with type 1 or type 2 diabetes in Australian adults. BMC Public Health. 2012;12(1):120.

19. Kawasaki E, Eguchi K. Is type 1 diabetes in the Japanese population the same as among Caucasians? Ann. NY Acad. Sci. 2004;1037(1):96-103.

20. Menke A, Orchard TJ, Imperatore G, Bullard KM, Mayer-Davis E, Cowie CC. The prevalence of type 1 diabetes in the United States. Epidemiology (Cambridge, Mass). 2013;24(5):773.

21. Anderson SG, Narayanan RP, Amlesh J, Qureshi MZ, Heald AH. Type 1 diabetes in Cheshire: cardiometabolic risk factor trends (2004–2009). Prim. Care Diab. 2012;6(2):123-6.

22. Mayer-Davis EJ, Kahkoska AR, Jefferies C, Dabelea D, Balde N, Gong CX, et al. ISPAD Clinical Practice Consensus Guidelines 2018: Definition, epidemiology, and classification of diabetes in children and adolescents. Pediatr. Diab. 2018;19:7-19.

23. Parkkola A, Härkönen T, Ryhänen SJ, Ilonen J, Knip M, Register FPD. Extended family history of type 1 diabetes and phenotype and genotype of newly diagnosed children. Diab. Care. 2013;36(2):348-54.

24. Gahagan S. Failure to Thrive: A Consequence of. Pediatrics in Review. 2006;27(1):e1-e11.

25. Munoz KA, Krebs-Smith SM, Ballard-Barbash R, Cleveland LE. Food intakes of US children and adolescents compared with recommendations. Pediatrics. 1997;100(3):323-9.

26. Kant AK. Reported consumption of low-nutrient-density foods by American children and adolescents: nutritional and health correlates, NHANES III, 1988 to 1994. Arch. Pediatr. Adolesc. Med. 2003;157(8):789-96.

27. Yardim MS, Ozcebe H, Araz OM, Uner S, Li S, Unlu H, et al. Prevalence of childhood obesity and related parental factors in Ankara, Turkey. 2018.

28. Sandhu N, Witmans MB, Lemay J-F, Crawford S, Jadavji N, Pacaud D. Prevalence of overweight and obesity in children and adolescents with type 1 diabetes mellitus. J. Pediatr. Endocrinol. Metab. 2008;21(7):631-40.

29. Phelan H, Clapin H, Bruns L, Cameron FJ, Cotterill AM, Couper JJ, et al. The Australasian Diabetes Data Network: first national audit of children and adolescents with type 1 diabetes. Med. J. Austr. 2017;206(3):121-5.

30. Daneman D. Assessment of intakes of artificial sweeteners in children with type 1 diabetes mellitus. Can. J. Diab. 2004;28(2):00-.

31. Betts P, Mulligan J, Ward P, Smith B, Wilkin T. Increasing body weight predicts the earlier onset of insulin-dependant diabetes in childhood: Testing the 'accelerator hypothesis'(2). Diab. Med. 2005;22(2):144-51.

32. Delahanty LM, Halford BN. The role of diet behaviors in achieving improved glycemic control in intensively treated patients in the Diabetes Control and Complications Trial. Diab. Care. 1993;16(11):1453-8.

33. Abd-Alrazak OM, Ghalib BA, Abduljabbar HA. Growth Indices among Children and Adolescents with Type 1 Diabetes-Baghdad–Iraq, 2013. J. Facult. Med. 2014;56(3):258-63.

34. Cardwell C, Patterson C, Allen M, Carson D. Diabetes care provision and glycaemic control in Northern Ireland: a UK regional audit. Arch Dis. Childhood. 2005;90(5):468-73.