

## DIABETES MELLITUS IN CHILDREN AND ADOLESCENTS IN NORTHERN SAUDI ARABIA

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### ABSTRACT

**Background:** World Health Organization has predicted a worldwide rise in the prevalence of diabetes mellitus. The objective of this study was to determine the prevalence of diabetes mellitus (DM) among children and adolescents in the district of Turaif, Northern Saudi Arabia. **Methods:** A cross-sectional descriptive survey included 589 children and adolescents aged 1–21 years were surveyed. Capillary random glucose was performed in all subjects. Random blood sugar level of 200 mg/dl or higher suggests diabetes level of > 140 mg/dl but < 200 mg/dl, suggests pre-diabetes. **Results:** The prevalence of DM and pre-diabetes were 1.7 % and 5.1 % respectively. No diabetic children below 5 years, 1.4% of children 5-10 years, 1.1% of 10-16 years and 3.2% of adolescents > 16 years were diabetic. On the other hand, 2.3% of children below 5 years were pre-diabetics, 5.7% of children aged 5-10 years, 1.1% of children aged 10-16 years, and 3.2% of adolescents > 16 years were pre-diabetic. Diabetes was more in males (1.8%) than females (1.6%) while 3.1% of males and 6.3% of females were pre-diabetics. However with regards to age and gender, there were no significant differences has been observed (P value >0.05). **Conclusion and recommendations:** The prevalence rate of DM among children and adolescents was 1.7%. Awareness campaigns and prevention programs about diabetes in childhood and adolescence should be instituted and the existing ones must be strengthened. Adequate commitment from the Ministry of Health is also advocated.

**Keywords:** Diabetes mellitus; Children; Adolescents; Turaif, Saudi Arabia; Random blood glucose.

### INTRODUCTION

The significant increase in the prevalence of obesity in children and adolescents over past decades caused the concomitant rise in the incidence of glucose intolerance and diabetes [1]. The emergence of diabetes mellitus as a global public health problem in children and adolescents is due to the widespread obesity and pronounced lifestyle changes [2]. In the past, type 1 diabetes used to be the predominant type among children, but for the last 20 years, type 2 diabetes [3, 4] which is known for its different etiology, is taking the lead. A special focus on identifying the factors behind the etiology of this new observation, especially in communities known for their high prevalence of type 2 diabetes, would help to understand this epidemiological shift.

There are limited number of community-based studies that have looked into the prevalence of type 1 and type 2 diabetes simultaneously among children and adolescents worldwide [5]. Between the years 1990 and 2008, the incidence of type 1 diabetes has almost doubled from 2.8% to 4.0% per year worldwide,<sup>6</sup> while that of type 2 diabetes has increased 10 times in young children aged 6–12 years and almost doubled among adolescents, rising from 7.3 to 13.9/100 000 between the years 1967 and 1997.<sup>4</sup> In the USA, a national data set reported that the prevalence of type 2 diabetes in youth aged 10–19 years had increased by 30.5% between 2001 and 2009 [6]. Obesity is a well-known risk factor for type 2 diabetes in children and adolescents, which is a consequence of high caloric intake and physical inactivity, in addition to the sharp increase in the use of computer and TV watching.<sup>7</sup>

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. 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) [8].

In the national surveillance for type 1, type 2 diabetes and pre-diabetes among children and adolescents: a population-based study (SAUDI-DM) by (Al-Rubeaan, 2017) The overall prevalence of diabetes was 10.84%, of which 0.45% were known type 1 and type 2 patients with diabetes and 10.39% were either newly identified cases of diabetes (4.27%) or IFG (6.12%) with more than 90% of the participants with diabetes being unaware of their disease. The prevalence of known type 1 and type 2 diabetes as well as the newly identified cases was higher than what has been reported internationally. Age, male gender, obesity, urban residency, high family income and presence of dyslipidaemia were found to be significant risk factors for diabetes and IFG. [9].

There has been no prevalence study of DM in children and adolescents conducted in the community, hence a need to target a large number of subjects and also collect the data in a “real life” community based setting.

Therefore, we conducted this study aimed to determine the prevalence of the DM among children and adolescents (1-21 years) in the district of Turaif, Northern Saudi Arabia, in order to provide data for possible early public health intervention.

## PARTICIPANTS AND METHODS

**Study design and setting:** A cross-sectional study, included 589 children and adolescents aged 1–19 years were surveyed during a health education campaign held in Turaif city for one week in July 2016. Turaif is a town in the Northern Borders Province, Saudi Arabia, close to the border with Jordan.

### Data collection

Participants were interviewed with structured questionnaires covering the following items:

- (1) Socio-demographic data which include participants' age, gender and family history of diabetes were collected by a standard questionnaire.
- (2) Case identification: Blood sample is drawn under complete a septic conditions to determine random blood glucose level. According to the American Diabetes Association (ADA) criteria 2003 [10]. Random blood sugar level of 200 milligrams

per deciliter (mg/dL) or higher suggests diabetes. Level of > 140 mg/dL but < 200 mg/dL, suggests prediabetes.

### Ethical considerations

Data collector gave a brief introduction to the parents or care givers by explaining the aims and benefits of the study. Informed written consent was obtained from all parents or care givers. Anonymity and confidentiality of data were maintained throughout the study. There was no conflict of interest.

### Statistical analysis

We utilized the statistical package for social sciences, version 16 (SPSS Inc., Chicago, Illinois, USA) to analyze the study data. The results were displayed as counts and percentages. The X<sup>2</sup> test was used as a test of significance, and differences were considered significant at P value less than 0.05.

## RESULTS

Table (1) illustrates the sex, age group (in years) and percentage distribution of the studied children into, normal, pre-diabetic and diabetics. It is clear from the table that, male to female was 38% to 62%. About third (31.6%) of the studied population were 16 – 21 years, 29.5% were 10-15 years, 23.9% were 5-9 years. Diabetic children constitute 1.7% and 5.1% were pre-diabetics.

Table (2) illustrates the relationship between diabetes diagnosis and sex of the studied children and adolescents, it is clear from the table that, Diabetes was more in males (1.8%) than females (1.6%) while 3.1% of males and 6.3% of females were pre-diabetics. However with regards to sex, there were no significant differences has been observed (P value >0.05).

Table (3) illustrates the relationship between diabetes diagnosis and age group of the studied children and adolescents. The prevalence of DM and pre-diabetes were 1.7 % and 5.1 % respectively. No diabetic children below 5 years, 1.4% of children 5-10 years, 1.1% of 10-16 years and 3.2% of adolescents > 16 years were diabetic. On the other hand, 2.3% of children below 5 years were pre-diabetics, 5.7% of children aged 5-10 years, 1.1% of children aged 10-16 years, and 3.2% of adolescents > 16 years were pre-diabetic. However with regards to age, there were no significant differences has been observed (P value >0.05).

**Table (1): Sex, age group (in years) and percentage distribution of the studied children into, normal, pre-diabetic and diabetics of the studied children and adolescents, Traif, KSA, 2016**

Sex	No. (n=589)	%
Male	224	38.0
Female	365	62.0
Total	589	100.0
<b>Age group (in years)</b>		
<5	88	14.9
5 –	141	23.9
10 –	174	29.5
16 – 21	186	31.6
<b>Diagnosis</b>		
Normal	549	93.2
Pre-diabetic	30	5.1
Diabetic	10	1.7

**Table (2): The relationship between diabetes diagnosis and sex of the studied children and adolescents, Traif, KSA, 2016**

Sex	Diabetes diagnosis			Total	Chi-Square	P value
	Normal	Pre-diabetic	Diabetic			
Male	Count	213	7	4	224	2.90
	% within sex	95.1%	3.1%	1.8%	100.0%	
Female	Count	336	23	6	365	
	% within sex	92.1%	6.3%	1.6%	100.0%	
Total	Count	549	30	10	589	
	% within sex	93.2%	5.1%	1.7%	100.0%	

**Table (3): The relationship between diabetes diagnosis and age group of the studied children and adolescents, Traif, KSA, 2016**

Age in years	Diabetes diagnosis			Total	Chi-square	P value
	Normal	Pre-diabetic	Diabetic			
< 5	Count	86	2	0	88	10.449
	% within age group	97.7%	2.3%	.0%	100.0%	
5-10	Count	131	8	2	141	
	% within age group	92.9%	5.7%	1.4%	100.0%	
10 – 16	Count	158	14	2	174	
	% within age group	90.8%	8.0%	1.1%	100.0%	
>16	Count	174	6	6	186	
	% within age group	93.5%	3.2%	3.2%	100.0%	
Total	Count	549	30	10	589	
	% within age group	93.2%	5.1%	1.7%	100.0%	

## DISCUSSION

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of various organs, especially the eyes, kidneys, nerves, heart, and blood vessels [12].

World Health Organization (WHO) has predicted a worldwide rise in the prevalence of diabetes mellitus (DM) that is expected to affect 300 million people by 2025 [13].

SA has witnessed significant lifestyle changes due to rapid urbanization, dominance of the automobile for personal travel, availability of high-fat and dense-caloric foods, satellite TV, increased reliance on computer and telecommunication technology and decreased occupational work demands. These lifestyle changes have had a considerable impact on reducing the physical requirements of daily life and have encouraged sedentary lifestyles amongst both young people and adults. This has, inevitably, led to a new pandemic of metabolic conditions such as obesity and type 2 diabetes [14].

Therefore, this study aimed to determine the prevalence of the DM among children and adolescents in the district of Turaif, Northern Saudi Arabia, in order to provide data for possible early public health intervention.

The prevalence of diabetes among the children and adolescents in the present study was 1.7%, (17 per 1000). This was higher than a Tunisian study by Ghannem et al [15] which reported a prevalence of 0.4 % amongst school children aged 13–19 years. However the observed prevalence is also higher than a prevalence of 0.3 % documented in a similarly designed Iranian study by Chakhadi et al. [16] among elementary school children though the age range in that study was between 6 to 12 years [16]. The prevalence was also higher than a rate of 3.2 per 1000 of diabetes among U.S. children aged less than 18 years of age from data released from the National Survey of Children's Health (NSCH) [17]. The prevalence in the US study [18] could have been under-reported because the NSCH used random-digit dialing to recruit and survey households and obtained parental response on whether the child had been diagnosed with diabetes. Similarly, the prevalence in the present study was also higher than a prevalence of 109.5 per 100,000 (1.095 per 1000) documented in a Saudi-Arabian questionnaire based study on type 1 DM by Al-Herbish et al. [8]. An added difference may be because only type 1 DM patients were reported in Saudi-Arabian study [8]. The prevalence rate in the present study was also higher than a case prevalence of 0.33/1000 in a South-Eastern Nigerian population based study by Afoke et al. [18] among school children aged 5–17 years. However a report in Cote d'Ivoire by Abodo et al. [19] reported a higher prevalence rate of 2.1 % among paediatric hospital admissions. In contrast, some other hospital based prevalence rates which ranged from 0.33-2/1000 reported in studies from South-East Nigeria, [20] were lower compared to the index study. In studying the prevalence of diabetes in children aged <15 yr. in Fiji, the prevalence of type I diabetes in 2012 was 5.9/100,000 and of type 2 was 2.4/100,000 [21]. Conversely, in Al-Rubeaan survey, the prevalence of diabetes was 10.83% among children and adolescents aged ≤18 years [9], another hospital based prevalence rate of 10.1/1000 in North-Central Nigeria by John et al. [22] was noted to be higher.

With regards to age and gender, there were no significant differences has been observed in the present study. There were no significant differences as has been observed in other studies [15, 16, 17, 18]. Even though the number of the subjects diagnosed with diabetes in the present study is small, it is however noteworthy that the male: female ratio of the diabetic subjects was 1.6-1.4 differ from to a significant male preponderance of 3:1 in the study by Afoke at al and 1:0.6 by Adeleke at al respectively [23, 24].

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