The prevalence of pre-diabetes and diabetes among secondary school students in Aden city 2013

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Abstract

Diabetes mellitus is one of the leading chronic diseases of childhood and adolescent. While it is said that type 2 diabetes occurs mostly in individuals over 30 years old and the incidence increases with age, it seems an alarming number of patients with type 2 diabetes who are barely in their teen years. In fact, for the first time in the history of humans, type 2 diabetes is now more common than type 1 in childhood.

The main objective of this study is to identify the prevalence of prediabetes and diabetes among secondary school students in Aden city during the period Nov. 20th 2012 - Feb 1st, 2013.

This was a secondary School based cross sectional study, performed in Aden, includes 200 who were students randomly selected.

Prediabetes was highly prevalence among adolescent 35.5%, 1% diabetic and 22.5% obese.

28.9% of the study population who had obesity are prediabetic while diabetic cases it was 2.2% , with 70.7% of the students prediabetic and 3.1% of student with diabetes have positive family history of diabetes.

These results shows high risk of diabetes and prediabetes among secondary school students which may expose them to early complications in adult life so early measures must be taken to improve this situation.

Key words: diabetes, pre diabetes, prevalence, secondary school, Aden

Introduction:

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defective insulin secretion, action, or both.[8] It is one of the leading chronic diseases of childhood and adolescence.[15] Although Type 1 diabetes mellitus (T1DM) is used to be the most common form in children, while type 2 diabetes (T2DM) occurs mostly in individuals over 30 years old and the frequency increases with age, however there is an alarming number of children with type 2 diabetes who are barely in their teens. In fact, for the first time in the history of humans, T2DM is now more common than T1DM in childhood.[14] Type 2 diabetes during childhood and adolescent first diagnosed among Pima Indian in 1979 with prevalence of 2–3% among those aged 15–19, but two decades later it would almost doubled.[7,19] The clinical manifestation of T2DM are preceded by asymptomatic prodromal period called pre-clinical or pre diabetic.[15]

The state of abnormal glucose metabolism, characterized as IFG or\and IGT, has been referred to as (Pre-diabetes).[10] This condition is characterized by peripheral insulin resistant and impaired glucose sensitivity in the first phase insulin secretion,[3] leading to elevated plasma glucose levels above the normal range, but below the threshold for diabetes.[17] The high prevalence of pre-diabetes among adolescents has raised public health concerns as adolescents with pre-diabetes usually have no apparent clinical symptoms and greater efforts may be needed to identify them early and to root the modifiable factors of insulin resistance such as overweight, physical inactivity, and unhealthy diet.[10]

The prevalence of prediabetes has increased markedly over the recent decade and the transition from prediabetes to diabetes may take many years, but may also be rapid.[16]

Early diagnosis of prediabetic state identifies persons at risk and help prevention of progression to T2DM and associated cardiovascular diseases.[17]

The Center for Diseases Control and Prevention (CDC) has estimated that, between 2002 and 2005, the incidence rate of T2DM is 8.5 for every 100,000 in children and adolescents.[21]

The young age at presentation exposes these patients to high risk of complications in adult life.[11,12]

It has been demonstrated that severely obese children and adolescent with prediabetes are at very high risk for developing T2DM over short period of time.[19] Most of these cases are a direct result of poor eating habits, higher body weight, and lack of exercise. While there is a strong genetic component for developing this form of diabetes, there are other risk factors(the most significant is obesity).[14]

Assuming that T2DM is preventable, there are two components to primary prevention:
First: strategy is needed to alter the life style and environmental determinant of T2DM. Second: high risk strategy is needed for screening individuals at specially high risk for T2DM and providing preventive care.[12]

On the base of all above mentioned, we decided to get the first step to identify the prevalence of prediabetes in our country, among adolescent in secondary school students and increase awareness to risk student about it, Also all cases who were diagnosed as diabetic, were given proper management.

The aim of this study is to determine the prevalence of prediabetes and diabetes among secondary school students in Aden city and to identify associated risk factors including obesity and family history of diabetes.

Objectives :

1. To identify the prevalence of prediabetes and diabetes students.
2. To asses the incidence of obesity and family history of diabetes.
3. To asses the incidences and the relationship of students age with prediabetes and with diabetes.
4. To identify the relationship of obesity with prediabetes and diabetes.
5. To identify the relationship between family history of diabetes with prediabetes and diabetes.

Methods:

This is across sectional study performed in asecondary school students in Aden in the period Nov2012- Feb 2013.

Seven schools were included in this study from which 200 students(15-19 years age) were randomly selected after having an informed consent for health, education, school authorities as well as students relatives.

Inclusion criteria: Fasting student

Exclusions criteria:

- ✓ Existing diagnosis of diabetes,
- ✓ Student who had eaten or drunk anything (except plain water) in the last 10 hours before blood test.

A pre-structured questionnaire was used and filled by the researcher himself through direct interviews, data were included age,sex, family history and diabetes and the anthropometric measurements .

Height was measured by stadiometer, weight by using digital balance .

Body mass index (BMI) was calculated in kg\m2 and used to assess obesity.[15,19]

Obesity is defined as an individual with body weight of higher than normal (both obese and risk of obesity) according to previous study.[19]

A finger stick blood capillary sample was taken for glycemic measure by researcher.

Diabetes is diagnosed when:

• a fasting plasma glucose **(FPG)** is ≥ 7.0 mmol/l (126 mg/dl),
or • the post challenge plasma glucose is >11.1 mmol/l (200 mg.dl)**,**

• performed as described by the World Health Organization, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water.
or • symptoms of diabetes and a casual plasma glucose was ≥ 200 mg/dl (11.1 mmol/L).[2.10,15,18,19]
ADA (American diabetes association) definition of prediabetes:
Patients are at increased risk for diabetes if they have 1 of the following 3 states:
• Impaired fasting glucose (IFG): IFG is a fasting plasma glucose level of 100-125 mg/dl,
• impaired glucose tolerance (IGT): A plasma glucose level (obtained 2 hours after a 75-g oral glucose challenge) > 140 mg/dL but < 200 mg/dl or
• hemoglobin A1c (A1c): beginning 5.7%-6.4% as an indicator of prediabetes .[13,17]

Statistical analysis:

All statistical analysis were performed, using SPSS (version 16)

Frequency and percentage were calculated for qualitative variable while mean and standard deviation were done for quantities variable.

Chi-square and fisher exact test were done for qualitative variables. The level of significance is considered with P value less than 0.05

Results and discussion:

229 students (4.9%) from the total number (4693) of girls attending to secondary schools of Aden governorate were involved in our study.

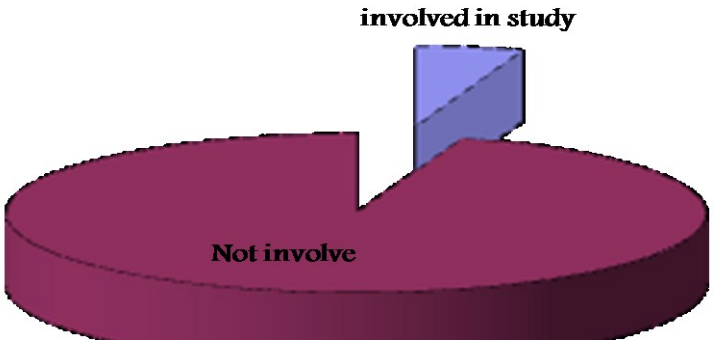

Figure: distribution of students involved in study.

29 of the students were excluded because they didn't meet our criteria (2cases under insulin therapy and the other already ate before blood test).

Prediabetes was highly prevalence among adolescent.[5] In few schools based studies the prevalence of prediabetic (IFG) was estimated to vary from 6.7% to 40.5%.[10]
Among the 200 students in our study who did blood test, 71 (35.0%) were prediabetic, this percentage is higher than reported in Egypt in astudy done by Aboulella et al with 16.4% prediabetes [8] and 23.0% prediabetes in Jordan.[20]

Table 1: Distribution of students according to blood glucose level

FBS	No	Percent
Normal	127	63.5%
Prediabetic(IFG)	71	35.5%
Diabetic	2	1.0%
Total	200	100%

The average risk of developing diabetes is about 5% to10% per year in individuals with IFG or IGT, compared with approximately 0.7% per year in normal glycemic individual.[16]

Patients with IFG and/or IGT were considered as having a new condition referred to, for the first time, as prediabetes. According to the recommendations of the American Diabetes Association (ADA), FPG is the preferred test for diagnosing diabetes and prediabetes because of its ease of use, acceptability to patients, and lower cost,[8] as IFG accounted for nearly 80% of adolescent with prediabetic.[10] So, prediabetes is recognized risk factor for both T2DM and cardiovascular diseases,[17]Most individuals, up to 70% with prediabetes, eventually develop diabetes.[8]

The prevalence T2DM in Yemeni population, according to CIA world face book 2008, is 9.8%,[13] this gives an alarming point to early identification of this situation and trying early discovering the diabetic cases and determination of the prediabetic condition in early age to improve the outcome.[9]

Among the 15-19 year old diabetic type 2 is an emerging public health problem, from which there is a great potential to improve primary and secondary prevention, The prevalence of diabetic, among this age group 4.5% for all U.S American Indians, [9] 5.0% for pima Indians,[4] 2.5% among Navajo youth,[11] and 2.3% for Canadian.[9]

according to our results there were two cases with diabetes undiagnosed with 1.0% which is lower than the previous study but near to what reported by Aboulella in Egypt 0.7%,[1] and to what reported by Narayanappa in India 1.53%.[15]

In our study, the mean age for students was 16.8 ± 0.9 years which is more similar to that reported for Mexican American adolescents had 16.9 ± 2.8 years old.[17]

Table 2: Distribution of prediabetic and diabetic students in relation to age

Age in Years	Normal		Prediabetic		Diabetic	
	No	%	No	%	No	%
15	11	55.0%	9	45.0%	0	0.0%
16	25	62.5%	14	35.0%	1	2.5%
17	61	63.5%	35	36.5%	0	0.0%
18	29	70.7%	11	26.8%	1	2.4%
19	1	33.3%	2	66.6%	0	0.0%
Total	127	63.5%	71	35.5%	2	1.0%

From this table it is clear that the incidences of prediabetes increase with the increasing age of students except age 18 year ,while diabetes appearance doesn't show the same thing.

Individuals with the following risk factors are associated with increased risk of T2DM:

- ✓ Being overweight.
- ✓ Family history of diabetes.
- ✓ Female gender. [21]

Obesity associated diabetes in adolescent is increasing throughout the world,[19] an association have been made between obesity epidemic among youth and increased sugar beverage consumption, as well as long hours in front of T.V screen and reduced physical activity.[4] The prevalence of obesity in adult, adolescent and children in middle east\north African region is amongst the highest world wide, ranging between 2% to 50% in female gender.[5]

Although such rapid economic growth brings with it great opportunity for the improvement in infrastructure (e.g. health care and education), it also carries it the burden of greater reliance on mechanization, a proliferation of western-style fast food, access to cheap migrant labor, and as elsewhere greater opportunities for sedentary lifestyles, especially in the young. These environmental factors fuel the emerging epidemic of T2DM in Arabic speaking nations, with these same factors also driving the current explosive increases in obesity in the Arabic speaking regions.[6]

Table3: Distribution of students according to BMI

Obesity	No	Percent
No	155	77.5%
Yes	45	22.5%
Total	200	100%

In this study, from Table (3), 45 students with 22.5% were obese, higher than reported in a study by Salameh et al Lebanon, where obesity was 14.5% in the same age group, [19] and near to what reported by Narayanappa et al with 24% .[15]

Table 4: Distribution of prediabetic and diabetic students in relation to obesity in weight

Obesity	Normal		Prediabetic		Diabetic	
	No	%	No	%	No	%
No	96	61.9%	58	37.4	1	0.6%
Yes	31	68.9%	13	28.9%	1	2.2%
Total	127	63.5%	71	35.5%	2	1.0%
Percentage by raw	p=0.39 statistically not significant					

In comparison with normal weight adolescent, obese adolescent had 2.6 fold higher rate of prediabetes,[17] 28.9% of the study population who had obesity were prediabetic, near to that study by Salameh ,Lebanon who reported 30.0% of prediabetic student were obese, [19] that is higher than that reported by Anna et al in the USA who reported 21.0% of obese adolescent were prediabetes,[3] while diabetic cases it was 2.2% as shown in Table (3) .

One or more of these factors may contribute to excess weight:

- ✓ Unhealthy eating pattern.
- ✓ Lack of physical activity.
- ✓ An inherited tendency.
- ✓ Hormonal or medical conditions.[11,21]

Table5: Distribution of prediabetic and diabetic students in relation to family history

Family history	Normal		Prediabetic		Diabetic	
	No	%	No	%	No	%
No	36	64.3%	20	35.7%	0	0.0%
First degree	51	63.8%	29	36.3%	0	0.0%
Second degree	40	62.5%	22	34.4%	2	3.1%
Total	127	63.5%	71	35.5%	2	1.0%
Percentage by raw	p=0.36 statistically not significant					

Family history of diabetes is strong factor for IFG, the presence of family history in a first-degree relative was associated with IFG, even in the absence of obesity,[17] this was seen in our study (table5) in which 36.3% of the students with prediabetic had first degree family history of diabetes, while 34.4% had second degree relative with D.M.

In Mexican children and adolescents IFG, according to ADA criteria was identified in 88% of those with positive family history of diabetes.[17]

Family history, with there being a marked increase in diabetes frequency with one parent and an even greater frequency with two parents having diabetes among Pima Indians age 15–19 year,[7] with 3.1% of students with diabetes mellitus have positive family history. Several studies have confirmed that lifestyle modification and treatment with pharmaco-logical agents, like metformin, can prevent or delay the onset of diabetes in individuals with impaired fasting glucose.[15]

This study has brought out an important point in prevalence of prediabetic and undiagnosed diabetes which further studies with sufficiently be samples larger must made. Also prevalence of diabetic and prediabetic in adolescent is not known.

An important step to prevent progression to diabetes among obese students reverting obesity through lifestyle modification that involve nutrition, education, behavior modification and exercise.

Conclusion:

1. Prevalence of prediabetes is 35.5% among secondary school students while diabetes is 1.0%.
2. Among students in secondry schools 22.5% of students are obese and 70.7% are with family history of diabetes (36.3% first degree,34.4% second degree).
3. Prediabetes students are characterized by positive family history of diabetes (36.3% and 32.0%) first and second degree respectively.
4. Diabetes students are characterized by 3.1% second degree family history and 2.2% obesity.

Recommendations:

1. Increase of population awareness about prediabetes and its important in early management to delay diabetes appearance.
2. Early discovering and measure taking for prediabetes individuals.
3. Further studies with sufficiently larger sample is recommended.

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معدل انتشار السكري الكامن ومرض السكري بين طلاب المدارس الثانوية في مدينة عدن 2013

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الملخص

يعد مرض السكري واحد من الأمراض المزمنة الرائدة في مجال الطفولة والشباب ,و يقال أن السكري من النوع الثاني غالباً ما يحدث لدى الأفراد أكثر من 30 سنة ويزيد معدل الإصابة مع التقدم في السن، هناك رؤية جديدة بأنَّ عدد هائل من المرضى الذين يعانون من مرض السكري النوع الثاني الذين هم بسن المراهقة من سنوات عمرهم. لكن واقعياً ولأول مرة في تاريخ البشرية، السكري من النوع 2 هو الآن أكثر شيوعاً من داء السكري نوع 1 في مرحلة الطفولة والشباب.
ويسبق النوع الثاني لمرض السكري مظهر من المظاهر السريرية تسمى أعراض ما قبل السريرية أو قبل السكري (السكري الكامن).
ولتحديد معدل انتشار مرض السكري والسكري الكامن بين طلاب المدارس الثانوية في مدينة عدن اقيمت الدراسة من 20 نوفمبر 2012 إلى الأول من فبراير، 2013. إذ ضمنت 200 طالبة من إجمالي عدد الفتيات اللاتي يرتادون المدارس الثانوية العامة في محافظة عدن.
السكري الكامن كان انتشاره عالي بين المراهقين وكان ٪ 35.05 وهو الأعلى بين الدراسات المختلفة.
أنَّ هذا الوضع بحاجة إلى وضع خطوات جادة للاكتشاف المبكر لحالات السكري والسكر الكامن في سن مبكرة لتحسين نتائجه المستقبلية. ولوحظ أيضا أنَّ 22.5٪ يعانون من السمنة، ومرض السكري وقد تبين أنَّ معدل السمنة بين حالات السكري الكامن هي 28.9٪ من الدراسة السمنة في حين بلغت حالات السكري 2.2٪.
70.7٪ من الطلاب الدين لديهم سكري كامن لديهم تاريخ عائلي لمرض السكري مع 3.1٪ من الطلاب يعانون من داء السكري لديهم تاريخ عائلي إيجابي. كل ما ذكر سابقاً يعطينا إشارة مهمة لنبدأ بأخذ الخطوات اللازمة لتحديد الحالات التي لديها سكري كامن خاصة بين طلاب المدارس الثانوية التي تعد الشريحة الأهم التي يبنى عليها مستقبل الغد.

الكلمات المفتاحية: مرض السكري، السكري الكامن، معدل انتشار، الثانوية، عدن.