Original Research
ISSN (Print): 2455-1244
ISSN (Online): 0971-913X
J Endocrinol Reprod. *Vol 26(2), 119-126, June 2022, DOI: 10.18311/jer/2022/28579*

Screening the Risk Factors of Diabetes Mellitus in 1st year MBBS and BDS Students of a Medical College in Bangladesh

Mohammad Abdul Hannan[1*], Shahjada Selim[2], Madhusudan Saha[3] and Mohammad Afzal Miah[4]

[1]Department of Endocrinology, North East Medical College and Hospital, Sylhet, Bangladesh; drtareq909@yahoo.com
[2]Department of Endocrinology, Bangabandhu Sheik Mujib Medical University, Dhaka, Bangladesh
[3]Department of Gastroenterology, North East Medical College and Hospital, Sylhet, Bangladesh
[4]Department of Medicine, North East Medical College and Hospital, Sylhet, Bangladesh

Abstract

Background: Type 2 diabetes (T2D) is a common and serious chronic debilitating disease. Until recently, type 2 diabetes has been typically regarded as a disease of the middle-aged and elderly. While this age group still maintains a higher risk than younger adults, evidence is accumulating that onset in those under 30 years is increasingly common. Type 2 diabetes and its complications constitute a major public health hazard affecting people in both developed and developing countries. Prevalence of type 2 diabetes has been increasing exponentially, across the World. Multiple risk factors of diabetes, delayed diagnosis, life-threatening complications, sub-therapeutic treatment, and higher treatment costs are some crucial barriers to the control of type 2 diabetes. **Aim of the Study:** This study aimed to assess the risk factors of T2D in 1st-year MBBS and BDS students of North East Medical College (NEMC), Sylhet, Bangladesh. **Methods:** This was an observational cross-sectional study undertaken at the Endocrine Outpatient Department in a Tertiary Care Hospital, Sylhet, Bangladesh, during the period from November 2017 to February 2018. Non-probability purposive sampling was done. Out of 145 MBBS and BDS students who got admitted in session 2017-2018, data of 143 students were included as a part of regular medical checkup after permission of the concerned authority. As applicable, all data were expressed as frequencies and mean ±SD or mean ±SE. Student's t-test and Chi-square test were conducted where the *p*-value <0.05 was considered significant. Data analysis was done using computer-based SPSS version-22.0. **Results:** Among the total of 143 participants, 36.8% were female, and the male-female ratio was 1:1.7. Among all of them, 53% belonged to the 17-20-year age group whereas the rest 47% belonged to the 21-22-year age group. In analyzing the association of risk factors among participants we observed that the highest number of participants was associated with a family history of DM which was 19.83%. Then 18.95%, 18.08%, 14.58%, 10.79%, 9.91%, 7.29%, 0.29%, and another 0.29% participants were associated with fast food, physical inactivity, rich food, acanthosis nigricans, overweight, obesity, HTN, and dyslipidemiaT2d, respectively. According to the *p* values, we did not find any significant correlation between T2D status with any risk factor in this study. **Conclusion:** The findings of this study indicate that family history of T2D, consumption of fast food, physical inactivity, consumption of rich food, acanthosis nigricans, and overweight are the most potential risk factors of diabetes mellitus for such participants. But we did not find any significant correlation among those risk factors. An oral glucose tolerance test (OGTT) may ensure more specific results for such a study.

Keywords: Blood Glucose, DM, MBBS Students, Risk factors, Type 2 Diabetes Mellitus

**Author for correspondence*

Article Received: 07.01.2022 Revised on: 07.04.2022 Accepted on: 14.05.2022

1. Introduction

Type 2 Diabetes (T2D) is a serious and common chronic disease. T2D and its complications constitute a major public health hazard affecting people in both developed and developing countries. It was, until recently, regarded as a disease of the middle-aged and elderly. While this age group still maintains a higher risk than younger adults, evidence is accumulating to the effect that its onset in those below 30 years of age is becoming common. The prevalence of T2D has been increasing exponentially across the globe. Multiple risk factors of diabetes, delayed diagnosis, life-threatening complications, sub-therapeutic treatment, and higher treatment costs are some crucial barriers to the control of type 2 diabetes. Between genetic and environmental factors, the development of early-onset T2D represents a complex interplay. The table summarizes the risk factors for developing early-onset T2D[1]. In the same study obesity, low physical activity, high sedentary behavior, socioeconomic status, no modifiable ethnicity (Pima Indian, Hispanic, Asian, and Afro-Caribbean), family history of type 2 diabetes mellitus, puberty, low birth weight, exposure to diabetes mellitus while in the uterus, female sex and previous gestational diabetes were considered as the potential risk factors of DM. Overall, the risk factors for T2D in early-onset are similar to those for late-onset T2D, with female sex and puberty being additional risk factors, which contribute to insulin resistance[1]. Overweight and obesity are becoming major problems in adolescents around the world[2]. The vast majority of those with early-onset T2D are obese (80–92%) compared with only 56% of older adults[3] with an inverse linear relationship between BMI and the age at diagnosis of T2D[4]. In India, a recent study found that the age-adjusted prevalence of being overweight among 13 to 18 years old was 18% in boys and 16% in girls[2]. Genetic predisposition plays an important role in the risk of developing T2D. Some 84% of UK adolescents with T2D have a family history of this disease while 56–71% have an affected parent or sibling[5]. Wilmot and Idris[1] have shown that having a first- or second-degree relative with T2D and with a strong family history among affected youth, with 45–80% having at least one parent with diabetes and 74–100% have a first or second degree relative with diabetes. While it is likely that a genetic predisposition increases the risk of early-onset T2D, families often share a similar environment. Physical inactivity is a key factor in the obesity, and diabetes epidemic in younger people[1]. Clustered metabolic risk (including insulin sensitivity) increases in a dose-dependent manner with decreasing physical activity in children aged 9–15 years[6]. Acanthosis nigricans is a well-established physical marker of insulin resistance and is reported to occur in up to 60–90% of young people with T2DM. This seems to be especially true for African Americans, Mexican Americans, and some Native Americans, but not in other populations such as in Japan[2]. In many studies it was found that in developed countries the risk of diabetes is highest in those with lower socioeconomic status; however, the opposite appears to apply in developing countries, where higher socioeconomic status is associated with an increased risk of diabetes. Physical inactivity probably explains these findings in both settings[2]. T2D was once considered a disease of older adults but the age at diagnosis is falling and it is now increasingly diagnosed in adolescents and young adults to the extent that T2D will soon become the predominant form of diabetes in some ethnic groups[7]. An inverse relationship exists between body mass index (BMI) and the age of onset of T2D[4] with severe weight gain at <40 years associated with a higher risk of T2D[8].

Thus, this study was conducted to assess the risk factors of T2D in 1st-year MBBS and BDS students of NEMCH, Bangladesh.

2. Materials and Methods

This was an observational cross-sectional study that was undertaken at the Endocrine outpatient department in a Tertiary Care Hospital, Sylhet, Bangladesh, during the period from November 2017 to February 2018. Non-probability purposive sampling was done. Out of 145 MBBS and BDS students who were admitted into the session 2017-2018, 143 students were included as the study subjects after permission of the concerned authority. The exclusion criteria were strictly adopted. Data were collected using a predesigned, pretested, semi-structured data collection sheet. Socio-demographic information was collected through face-to-face interviews, and reports of RBS were recorded in the checklist. Physical examination and related measurements were done. Materials needed for the study were Sphygmomanometer, Stethoscope, weighing scale, height measuring scale, waist circumference measuring tape, etc. The laboratory of the Department of Pathology of NEMCH was chosen as the reference laboratory for the study. Demographic variables were age, sex, area of residence, and family history of

diabetes. Clinical variables were physical inactivity, weight gain, blood pressure, acanthosis nigricans vigilance, and waist circumference. The biochemical variable was Random Blood Sugar (RBS). All data were expressed as frequencies and means ±SD or means ± SE as applicable. Student's *t*-test and Chi-square test were conducted where the *p*-value <0.05 was considered as significant. Data analyses were done using computer-based SPSS version 20.0.

3. Result

Table 1. Socio-demographic characteristics of the participants (N=143)

Characteristics	Frequency (n)	Percentage (%)
Gender		
Male	90	63.2
Female	53	36.8
Age group (In years)		
17–19 yrs.	98	68.5
20–22 yrs.	45	31.5
Residence		
Urban	105	73.4
Rural	38	26.6
Nationality		
Bangladesh	84	58.7
Nepal	59	41.3

The table shows that out of the total 143 students, 90 (63.2%) were males and 53 (36.8%) were females. According to the age of the participants, 98 (68.5%) belonged to the 17–19-year age group, and 45 (31.5%) were in the 20–22-year age group. Among 143 students 105 (73.4%) were living in urban areas and the remaining 38 (26.6%) were from rural areas. According to nationality, 84 (58.7%) were Bangladeshi students and 59 (41.3%) were Nepalese students.

Table 2. Participant's gender, age, area, and country-wise risk factors analysis (N=143)

Risk Factor	Total	Male	Female	17-19 yrs.	20-22 yrs.	Urban	Rural	Bangladeshi	Nepalese
Family History of DM	68 (47.6)	37 (25.9)	31 (21.7)	51 (35.7)	17 (11.9)	50 (35.0)	18 (12.6)	48 (33.6)	20 (14.0)
Fast Food	65 (45.5)	40 (28.0)	25 (17.5)	43 (30.1)	22 (15.4)	53 (37.1)	12 (8.4)	39 (27.3)	26 (18.2)
Physical Inactivity	62 (43.4)	30 (21.0)	32 (22.4)	45 (31.5)	17 (11.9)	46 (32.2)	16 (11.2)	40 (28.0)	22 (15.4)
Rich Food	50 (35.0)	35 (24.5)	15 (10.5)	31 (21.7)	19 (13.3)	42 (29.4)	8 (5.6)	18 (12.6)	32 (22.4)
Acanthosis Nigricans	37 (25.9)	22 (15.4)	15 (10.5)	24 (16.8)	13 (9.1)	29 (20.3)	8 (5.6)	24 (16.8)	13 (9.1)
Overweight	34 (23.8)	24 (16.8)	10 (7.0)	23 (16.1)	11 (7.7)	25 (17.5)	9 (6.3)	20 (14.0)	14 (9.8)
Obese	25 (17.5)	15 (10.5)	10 (7.0)	17 (11.9)	8 (5.6)	23 (16.1)	2 (1.4)	16 (11.2)	9 (6.3)
HTN	1 (0.7)	1 (0.7)	0 (0.0)	1 (0.7)	0 (0.0)	1 (0.7)	0 (0.0)	0 (0.0)	1 (0.7)
Dyslipidemia	1 (0.7)	1 (0.7)	0 (0.0)	1 (0.7)	0 (0.0)	1 (0.7)	0 (0.0)	0 (0.0)	1 (0.7)

The table analyses the risk factors of DM. Out of the 143 students, the risk factor indicators were family history of DM, which was present in 68 (47.6%), followed by fast food consumption in 65 (45.5%), physical inactivity in 62 (43.4%), rich food consumption in 50 (35%), 37 (25.9%) acanthosis nigricans, 34 (23.8%) overweight and 25 (17.5%) obese.

Table 3. Group-wise diabetes risk factor status: Family history of DM (n=68)

Diabetes status	n	%
Diabetes unlikely (less than 5.5)	21	30.9
Diabetes uncertain Group-1 (5.5-7.7)	41	60.3
Diabetes uncertain Group-2 (7.8-11.0)	6	8.8
Diabetes likely (more than 11.0)	0	0.0

The table shows that out of the 68 students with a family history of DM risk factors, diabetes was unlikely for 21 (30.9%), followed by diabetes uncertain group 1, 41 (60.3%), and diabetes uncertain group 2, 6 (8.8%).

Table 4. Group-wise diabetes risk factor status: Fast food consumption (n=65)

Diabetes status	n	%
Diabetes unlikely (less than 5.5)	21	32.3
Diabetes uncertain Group-1 (5.5-7.7)	40	61.5
Diabetes uncertain Group-2 (7.8-11.0)	4	6.2
Diabetes likely (more than 11.0)	0	0.0

The table shows fast food consumption as possible diabetes risk factor. Out of the 65 students, 21 (32.3%) were in diabetes unlikely group, 40 (61.5%) were in diabetes uncertain group 1, and 4 (6.2%) were in diabetes uncertain group 2.

Table 5. Group-wise diabetes risk factor status: Physical inactivity (n=62)

Diabetes status	n	%
Diabetes unlikely (less than 5.5)	19	30.6
Diabetes uncertain Group-1 (5.5-7.7)	37	59.7
Diabetes uncertain Group-2 (7.8-11.0)	6	9.7
Diabetes likely (more than 11.0)	0	0.0

The table shows physical inactivity as possible diabetes risk factor. Out of the 62 students, 19 (30.6%) were in the diabetes unlikely group, 37 (59.7%) in the diabetes uncertain group 1, and 6 (9.7%) in the diabetes uncertain group 2.

Table 6. Group-wise risk factor status: Consumption of rich food (n=50)

Diabetes status	n	%
Diabetes unlikely (less than 5.5)	15	30.0
Diabetes uncertain Group-1 (5.5-7.7)	30	60.0
Diabetes uncertain Group-2 (7.8-11.0)	5	10.0
Diabetes likely (more than 11.0)	0	0.0

The table shows consumption of rich food as risk factor of diabetes. Out of 50 students, 15 (30%) were in the diabetes unlikely group, 30 (60%) were in diabetes uncertain group 1, and 5 (10%) were in diabetes uncertain group 2.

Table 7. Group-wise diabetes risk factor status: Acanthosis nigricans (n=37)

Diabetes status	n	%
Diabetes unlikely (less than 5.5)	10	27.0
Diabetes uncertain Group-1 (5.5-7.7)	22	59.5
Diabetes uncertain Group-2 (7.8-11.0)	5	13.5
Diabetes likely (more than 11.0)	0	0.0

The table shows acanthosis nigricans as a risk factor. Diabetes unlikely group was 10 (27%), diabetes uncertain group 1 was 22 (59.5%) and diabetes uncertain group 2 was 5 (13.5%).

Table 8. Group-wise diabetes risk factor status: Overweight (n=34)

Diabetes status	n	%
Diabetes unlikely (less than 5.5)	14	41.2
Diabetes uncertain Group-1 (5.5-7.7)	17	50.0
Diabetes uncertain Group-2 (7.8-11.0)	3	8.8
Diabetes likely (more than 11.0)	0	0.0

The table shows overweight as risk factor. Among the 34 overweight students 14 (41.2%) were in the diabetes unlikely group, 17 (50%) in diabetes uncertain group 1 and 3 (8.8%) were in diabetes uncertain group 2.

Table 9. Group-wise diabetes risk factor status: Obesity (n=25)

Diabetes status	n	%
Diabetes unlikely (less than 5.5)	6	24.0
Diabetes uncertain Group-1 (5.5-7.7)	16	64.0
Diabetes uncertain Group-2 (7.8-11.0)	3	12.0
Diabetes likely (more than 11.0)	0	0.0

The table shows obesity as risk factor. Out of 25 students, 6 (24%) were in the diabetes unlikely group, 16 (64%) were in the diabetes uncertain group 1 and 3 (12%) were in the diabetes uncertain group 2.

Table 10. Group-wise diabetes risk factor status: HTN (n=1)

Diabetes status	n	%
Diabetes unlikely (less than 5.5)	0	0.0
Diabetes uncertain Group-1 (5.5-7.7)	0	0.0
Diabetes uncertain Group-2 (7.8-11.0)	1	100.0
Diabetes likely (more than 11.0)	0	0.0

The table shows HTN risk factor. One student was in diabetes uncertain group 2.

Table 11. Diabetes group-wise risk factor status: Dyslipidemia (n=1)

Diabetes status	n	%
Diabetes unlikely (less than 5.5)	0	0.0
Diabetes uncertain Group-1 (5.5-7.7)	0	0.0
Diabetes uncertain Group-2 (7.8-11.0)	1	100.0
Diabetes likely (more than 11.0)	0	0.0

The table shows dyslipidemia as the diabetes risk factor. Only 1 student was in diabetes uncertain group 2.

Table 12. Nation-wise risk factor distribution (N=143)

Diabetes Risk Factor	Total Students (%)	Bangladeshi Students (%)	Nepalese Students (%)	p-Value
Family history of DM	68 (47.55)	48 (57.14)	20 (33.9)	0.006[s]
Fast-food habit	65 (45.45)	39 (46.43)	26 (44.07)	0.782[ns]
Physical inactivity	62 (43.36)	40 (47.62)	22 (37.29)	0.223[ns]
Rich food habit	50 (34.97)	18 (21.43)	32 (54.24)	0.000[s]
Acanthosis nigricans	37 (25.87)	24 (28.57)	13 (22.03)	0.383[ns]
Overweight	34 (57.63)	20 (55.56)	14 (60.87)	0.560[ns]
Obese	25 (42.37)	16 (44.44)	9 (39.13)	0.991[ns]
HTN	1 (0.70)	0 (0.0)	1 (1.69)	0.234[ns]
Known dyslipidemia	1 (0.70)	0 (0.0)	1 (1.69)	0.234[ns]

The table shows that out of 143 students, 68 (47.55%) had family history as risk factor for DM. Among them 8 (57.14%) were Bangladeshi students, and 20 (33.9%) were Nepalese students (p=0.006). As regards consumption of fast foods as risk factor, among the 65 (45.45%) students, Bangladeshi students were 39 (46.43%) and Nepalese students were 26 (44.07%). Physical inactivity was risk factor in 62 (43.36%) students among whom 40 (47.62%) were Bangladeshi students and 22 (37.29%) were Nepalese students. Consumption of rich foods was risk factor in 50 (34.97%) students among whom 18 (21.43%) were Bangladeshi students and 32 (54.24%) were Nepalese students. Acanthosis nigricans was risk factor in 37 (25.87%) students of whom 24 (28.57%) were Bangladeshi students and 13 (22.03%) were Nepalese students. Overweight was risk factor in 34 (57.63%) students of whom 20 (55.56%) were Bangladeshi students and 14 (60.87%) were Nepalese students. Obesity was risk factor in 25 (42.37%) students of whom 16 (44.44%) were Bangladeshi students and 9 (39.13%) were Nepalese students. Finally, in only 2 Nepalese students (1.69%) hypertension (HTN) and dyslipidemia were risk factors, one each of hypertension (HTN) and dyslipidemia.

4. Discussion

This study aimed to assess the risk factors of DM in 1st-year MBBS and BDS students of NEMCH, Bangladesh. In this study, in analyzing the association of risk factors among participants we observed, the highest number of participants was associated with family history of DM which was 47.06%. Then 45.5%, 43.4%, 35%, 25.9%, 23.8%, 17.5%, 0.7% and 0.7% participants were associated with fast food, physical inactivity, rich food, acanthosis nigricans, overweight, obesity, HTN and dyslipidemia, respectively. The most prevalent risk factor for T2D was sedentary lifestyle, which was also predominant among the investigated women, confirming the results of Brazilian and international studies involving college students[9,10]. On the other hand, data from the Brazilian Ministry of Health indicate similar percentages of lack of physical exercise among male and female adults[11]. In the present study, in analyzing the risk factors of DM against several levels of blood glucose levels we observed, a family history of DM was associated among 30.9%, 60.3%, and 8.8% of diabetes unlikely (less than 5.5), diabetes uncertain group I (5.5-7.7) and diabetes uncertain group II (7.8-11.0), respectively (p<0.532). Fast

Table 13. Logistic regression of risk factors with Diabetes Uncertain Group-2 (7.8-11.0)

Characteristics	OR	SE	95% CI		p-Value
			Lower	Upper	
Family history of DM	1.11	0.412	0.497	2.391	0.532^{ns}
Fast-food habits	0.681	0.401	0.311	1.47	0.724^{ns}
Physical inactivity	0.913	0.422	0.417	2.105	0.113^{ns}
Rich food habits	1.239	0.441	0.531	2.885	0.848^{ns}
Acanthosis nigricans	1.262	0.552	0.428	3.726	0.345^{ns}
Overweight	0.219	0.591	0.107	0.791	0.430^{ns}
Obesity	0.221	0.602	0.059	0.773	0.957^{ns}
HTN	0.922	0.461	0.426	2.082	0.643^{ns}
Known Dyslipidemia	1.305	0.508	0.438	3.711	0.656^{ns}

food consumption was associated among 32.3%, 61.5%, and 6.2% of diabetes unlikely (less than 5.5), diabetes uncertain group I (5.5-7.7), and diabetes uncertain group II (7.8-11.0), respectively (p<0.724). Physical inactivity was associated among 30.6%, 59.7%, and 9.7% of diabetes unlikely, diabetes uncertain group I, and diabetes uncertain group II, respectively (p=0.113). The habit of rich food taking was associated among 30%, 60%, and 10% of diabetes unlikely, diabetes uncertain group I, and diabetes uncertain group II, respectively (p<0.848). Acanthosis nigricans was associated among 27%, 59.5%, and 13.5% of diabetes unlikely, diabetes uncertain group I, and diabetes uncertain group II, respectively (p=0.345). Over body-weight was associated among 41.2%, 50%, and 8.8% of diabetes unlikely, diabetes uncertain group I, and diabetes uncertain group II, respectively (p=0.430). Obesity was associated among 24%, 64%, and 12% of diabetes unlikely, diabetes uncertain group I, and diabetes uncertain group II, respectively (p=0.957). However, we did not find any significant correlation of DM status with any risk factor in this study. Overweight and obesity involve a complex network of triggering factors, such as sedentary lifestyle, inappropriate eating habits, and cultural and environmental issues, which may justify the results of studies that indicated the predominance of excess weight in women[4]. In this study, most of the participants were young adults, confirming the students with some risk factors where obesity, fast food, physical inactivity, and nutritiously rich food were the most prevalent, but without statistical significance. Overweight and obesity involve a complex network of triggering factors, such as sedentary lifestyle, inappropriate eating habits, and cultural and environmental issues, which may justify the results of studies that indicated the predominance of excess weight in women[4]. The relation between excess weight and marital status was confirmed in other studies but has not been sufficiently clarified yet, revealing a knowledge gap[8]. The levels detected for central obesity, blood pressure, and glucose were similar to other publications reviewed[12]. The predominance of adiposity among women and of high blood pressure and glucose among men is also similar to other studies involving college students[13,14]. Although in this study we have not found any correlation of several risk factors with the DM status of our participants we should be aware of the health status of such students to save them from DM. The studies in the west have used some biochemical parameters or have included questions on fruit or vegetable consumption or antihypertensive therapy for deriving risk scores[15,16].

5. Conclusions and Recommendations

Until recently, type 2 diabetes has been viewed as a disease in older adults. But with increasing rates of obesity, it is clear that the age of disease onset is falling in all ethnic groups and that type 2 diabetes is occurring in childhood. The pathophysiology of type 2 diabetes in children and

adolescents appears to be very similar to that of adults. The findings of this study indicate that a family history of DM, the habit of fast food taking, physical inactivity, consumption of nutritiously rich food, acanthosis nigricans, and being overweight may be the most potential risk factors of diabetes mellitus for such participants. An Oral Glucose Tolerance Test (OGTT) may ensure more specific results for such a study. For getting more reliable information we would like to recommend conducting more studies in multiple centers with large sample sizes.

6. References

1. Wilmot E, Idris I. Early-onset type 2 diabetes: Risk factors, clinical impact, and management. Therapeutic Advances in Chronic Disease. 2014; 5(6):234–44. https://doi.org/10.1177/2040622314548679. PMid:25364491. PMCid:PMC4205573
2. Alberti G, Zimmet P, Shaw J, Bloomgarden Z, Kaufman F, Silink M. Type 2 diabetes in the young: The evolving epidemic: The international diabetes federation consensus workshop. Diabetes Care. 2004; 27:1798–811. https://doi.org/10.2337/diacare.27.7.1798. PMid:15220270
3. Hsia Y, Neubert AC, Rani F, Viner RM, Hindmarsh PC, Wong ICK. An increase in the prevalence of type 1 and 2 diabetes in children and adolescents: results from prescription data from a UK general practice database. British Journal of Clinical Pharmacology. 2009; 67:242–9. https://doi.org/10.1111/j.1365-2125.2008.03347.x. PMid:19260863. PMCid:PMC2670382
4. Hillier T, Pedula K. Characteristics of an adult population with newly diagnosed type 2 diabetes. The relation of obesity and age of onset. Diabetes Care. 2001; 24:1522–7. https://doi.org/10.2337/diacare.24.9.1522. PMid:11522693
5. Haines L, Wan KC, Lynn R, Barrett TG, Julian P.H. Shield, MD. Rising incidence of type 2 diabetes in children in the U.K. Diabetes Care. 2007; 30:1097–101. https://doi.org/10.2337/dc06-1813. PMid:17259470
6. Andersen L., Harro M., Sardinha L., *et al.* Physical activity and clustered cardiovascular risk in children: A cross-sectional study (The European Youth Heart Study). Lancet. 2006; 368. https://doi.org/10.1016/S0140-6736(06)69075-2
7. Sharp P, Brown B, Qureshi A. Age at diagnosis of diabetes in a secondary care population: 1992–2005. Br J Diabetes Vasc Dis. 2008; 8:92–5. https://doi.org/10.1177/14746514080080020701
8. Schienkiewitz A, Schulze MB, Hoffmann K, Kroke A, Boeing H. Body mass index history and risk of type 2 diabetes: Results from the European Perspective Investigation into Cancer and Nutrition (EPIC)-Potsdam Study. American Journal of Clinical Nutrition. 2006; 84:427–33. https://doi.org/10.1093/ajcn/84.2.427. PMid:16895894
9. Mokdad A, Bowman B, Engelgau M, Vinicor F. Diabetes trends in the U.S.: 1990–1998. Diabetes Care. 2000; 23:1278–83. https://doi.org/10.2337/diacare.23.9.1278. PMid:10977060
10. Kitagawa T, Owada M, Urakami T, Yamauchi K. Increased incidence of non-insulin-dependent diabetes mellitus among Japanese schoolchildren correlates with an increased intake of animal protein and fat. Clinical Pediatrics. 1998; 37:111–15. https://doi.org/10.1177/000992289803700208. PMid:9492119
11. Koopman R, Mainous A, Diaz V, Geesey M. Change in age at diagnosis of type 2 diabetes mellitus in the United States, 1988 to 2000. Annals of Family Medicine. 2005; 3:60–3 https://doi.org/10.1370/afm.214. PMid:15671192. PMCid:PMC1466782
12. Dean H, Flett B. Natural history of type 2 diabetes diagnosed in childhood: Long term follow-up in young adult years. Diabetes. 2002; 51(Suppl. 2):A24
13. Eppens MC, Craig ME, Cusumano J, Hing S, Chan AKF, Howard NJ, *et al.* Prevalence of diabetes complications in adolescents with type 2 compared with type 1 diabetes. Diabetes Care. 2006; 29:1300–6. https://doi.org/10.2337/dc05-2470. PMid:16732012
14. Ashok P, Kharche JS, Joshi AR. Evaluation of risk for type 2 diabetes mellitus in medical students using Indian Diabetes Risk Score. Indian Journal of Medical Sciences. 2011; 65(1):1–6. https://doi.org/10.4103/0019-5359.103159. PMid:23134940
15. Lindstrom J, Tuomilehto J. The diabetes risk score: a practical tool to predict type 2 diabetes risk. Diabetes Care. 2003; 26:725–31. https://doi.org/10.2337/diacare.26.3.725. PMid:12610029
16. Nelson KM, Boyko EJ. Third National Health and Nutrition Examination Survey. Predicting impaired glucose tolerance using common clinical information: data from the Third National Health and Nutrition Examination Survey. Diabetes Care. 2003; 26:2058–62. https://doi.org/10.2337/diacare.26.7.2058. PMid:12832313