International Journal of Medical and Health Research
ISSN: 2454-9142, Impact Factor: RJIF 5.54
www.medicalsciencejournal.com
Volume 2; Issue 8; August 2016; Page No. 21-26

An accurate risk score based on abdominal obesity & physical activity (Modifiable risk factors) to predict the development of type 2 diabetes mellitus

[1] Dr. Nikhil Jariwala, [2] Dr. Arun Tyagi

[1] Resident, department of medicine, PVVPF's medical College, Vilad Ghat, Ahmednagar, Maharashtra, India
[2] Prof. & Head, Department of Medicine, PVVPF's Medical College, Vilad Ghat, Ahmednagar, Maharashtra, India

Abstract
Diabetes is fast gaining the status of a potential epidemic in India with more than 62 million diabetic individuals currently diagnosed with the disease. In 2000, India (31.7 million) topped the world with the highest number of people with diabetes mellitus followed by China (20.8 million) with the United States (17.7 million) in second and third place respectively. According to Wild *et al.* the prevalence of diabetes is predicted to double globally from 171 million in 2000 to 366 million in 2030 with a maximum increase in India. It is predicted that by 2030 diabetes mellitus may afflict up to 79.4 million individuals in India, while China (42.3 million) and the United States (30.3 million) will also see significant increases in those affected by the disease. India currently faces an uncertain future in relation to the potential burden that diabetes may impose upon the country. Many influences affect the prevalence of disease throughout a country, and identification of those factors is necessary to facilitate change when facing health challenges. So what are the factors currently affecting diabetes in India that are making this problem so extreme? The Indian Diabetes Risk Score, derived by CURES, proves to be a worthy screening program for early detection of diabetes. This score should be recommended for usage by family physicians& health care workers, so that they may advise their patients in a better manner. There should be implementation of universal screening and primary prevention programs to detect diabetes at an earlier stage before development of complications.

Keywords: Diabetes mellitus type 2, modifiable risk factors, abdominal obesity, Physical activity

1. Introduction

India has earned the dubious distinction of being the diabetic capital of the world and there are an estimated 62 million people with diabetes in India today. Unfortunately, over half of these people remain undiagnosed as diabetes is a "silent" disease. The need for a simple screening tool for detecting undiagnosed people with diabetes in the community is therefore obvious. The Indian Diabetes Risk Score (IDRS), a simple screening tool for prediction of undiagnosed diabetes developed by Dr. Mohan and colleagues at the Madras Diabetes Research Foundation (MDRF), Chennai.

IDRS was derived from the Chennai Rural Epidemiology Population Study (CURES) and was internally validated using the data from the Chennai Urban Population Study (CUPS).The MDRF- IDRS uses a scoring system of 0 to 100 and a value of ≥ 60 had a sensitivity of 72.5% and specificity of 60.1% for recognizing undiagnosed diabetes with the Area Under the Curve (AUC) for the Receivers Operating Characteristic (ROC) Curve of 0.698.This risk score was derived using four simple variables namely age, family history, physical activity and waist circumference. Individuals were classified as high risk (score ≥ 60), moderate risk score (30 - 50) and low risk (score < 30). A recent study from the same group showed that MDRF - IDRS not only predicted diabetes but also predicted metabolic syndrome, even in subjects who had normal glucose tolerance.

Indian Diabetes Risk Score [IDRS] developed based on multiple logistic regression analysis derived from CURES

Particulars	Score
Age [years]	
< 35 [reference]	0
35-49	20
≥ 50	30
Abdominal obesity	
Waist <80 cm [female], <90 [male] [reference]	0
Waist ≥ 80 – 89 cm [female], ≥ 90 – 99 cm [male]	10
Waist ≥90 cm [female], ≥ 100 cm [male]	20
Physical activity	
Exercise [regular] + strenuous work [reference]	0
Exercise [regular] or strenuous work	20
No exercise and sedentary work	30
Family history	
No family history [reference]	0
Either parent	10
Both parents	20

2. AIMS and objectives

1. To validate modifiable risk factors of IDRS in screening of T2DM.
2. To compare the prevalence of risk factors of diabetes in diabetic and nondiabetic subjects.

3. Material and Methods

The present study entitled was conducted in the Department of Medicine PDVVPF's Medical College, Ahmednagar over a period of 6 months from July 2015 to Dec 2015.

The study group included persons who were either admitted in Department of Medicine, PDVVPF'S Medical College or attended medicine outpatient department.

Assessment of Indian Diabetic Risk score

The information for these risk factors can be obtained based on two simple questions and one anthropometric measurement namely waist circumference. The two questions are:

1. Do you exercise regularly?
2. How physically demanding is your work [occupation]?

Precise measurement of waist circumference

The WHO (WHO 1995) recommended methods are as follows. For waist or abdominal circumference, the subject stands with feet 25-30 cm apart, weight evenly distributed. Measurement is taken midway between the inferior margin of the last rib and the iliac crest in a horizontal plane. The measurer sits by the side of the subject and fits the tape snugly but not compressing soft tissues. (WHO 1995).

Assessment of physical activity

The information for physical activity can be obtained by two simple questions.

1. Do you exercise regularly?
2. How physically demanding is your work [occupation]?

How do we grade physical activity for calculating the score?

Try to get answer the following questions and mark the scores as shown below

a) How physically demanding is your work (occupation)?
   0 – Sedentary
   1 – Mild
   2 – Moderate
   3 – Heavy
b) Do you exercise regularly in your leisure time?
   0 - Not at all
   1 - less than 3 times a week
   2 - ≥ 3 times a week
   3 - almost daily
c) How would you grade your physical activity at home?
   0 - Sedentary
   1 - Mild
   2 - Moderate
   3 - Strenuous

If the combined score of a, b and c is

≥ 3 - Vigorous / strenuous: Score = 0
2 - Moderate: Score = 10
1 - Mild: Score = 20
0 - Sedentary: Score = 30

Inclusion criteria

1. Age group between 30 to 60 year.
2. Cases with IDRS ≥30.

Exclusion criteria

1. Known cases of Diabetes Mellitus Type 2 were excluded.
2. Diabetes Mellitus Type 1
3. Maturity Onset Diabetes of Young
4. Gestational Diabetes Mellitus

The patients were diagnosed as diabetics as per recommendations of WHO and National Diabetes Data Group (American Diabetes Association 2011).

1. Patients with classical symptoms of hyperglycemia or hyperglycemic crisis plus random blood glucose concentration ≥ 200 mg/dl (≥11.1 mmol/L).
2. Fasting plasma glucose ≥ 126 mg/dl (≥7 mmol/L), fasting is defined as no caloric intake for at least 8 hours.
3. Two hours plasma glucose > 200 mg/dl (≥ 11.1 mmol/L) during an oral glucose tolerance test. The test should be performed as described by WHO, using a glucose load containing the equivalent of 75 gm anhydrous glucose dissolved in water.
4. HbA1c ≥6.5%. The test should be performed in a laboratory using a method that is National Glycohemoglobin Standardization Program (NGSP)-certified and standardized to the Diabetes Control and Complications Trial (DCCT) assay.

4. Results

Table 1: Distribution of cases according to educational status

S. No.	Religion	IDRS				Total %	
		30-50 % (n=150)		≥60 % (n=350)			
1	Illiterate	86	*71.66*	34	*28.34*	120	*24.00*
2	Literate	64	*16.84*	316	*83.16*	380	*76.00*
a)	Primary School	(48)	*75.00*	(56)	*17.72*	(104)	*27.37*
b)	Secondary	(16)	*25.00*	(72)	*22.78*	(88)	*23.16*
c)	Graduate	-	-	(156)	*49.37*	(156)	*41.05*
d)	Postgraduate	-	-	(32)	*10.13*	(32)	*8.42*

P value < 0.0001

The above table shows 76% of cases were literate and 24% were illiterate. Among the 76% of literate 83% were belonged to IDRS≥60. Even though statistically significant it may be biased because of higher number of literates in the study.

Table 2: Distribution of cases according to BMI

S. No.	IDRS	BMI							
		<18.5 %		18.5-24.9 % (n=198)		25-29.9 % (n=238)		≥30 % (n=64)	
1	30-50 (n=150)	-	-	138	69.69	12	5.0	-	-
2	≥60 (n=350)	-	-	60	30.31	226	95.0	64	100.0

P value < 0.0001

The above table shows that the individuals with BMI >30 all belonged to IDRS score of ≥60.Among the 238 cases with BMI 25-29.9,95%of cases belonged to IDRS score≥60.Which is statistically significant with P value <0.0001.

Table 3: Relationship of BMI to sex

S. No.	BMI	Sex			
		Male % (n=300)		Female % (n=200)	
1	<18.5	-	-	-	-
2	18.5-24.9(n=198)	130	43.33	68	34.00
3	25-29.9(n=238)	137	45.67	101	50.50
4	30-34.9(n=42)	21	7.00	21	10.50
5	≥35(n=22)	12	4.00	10	5.00

P value 0.1543

The above table shows 13% of males and 15.5% of females were obese, and 45% of males and 50.5%of females were overweight which is statistically insignificant.

Table 4: Relation of BMI to HBA1c

S. No.	BMI	HbA1c					
		<5.6 % (n=283)		5.7 -6.4 % (n=131)		> 6.5 % (n=86)	
1	<18.5	-	-	-	-	-	-
2	18.5-24.9(n=198)	156	78.78	26	13.13	16	08.09
3	25-29.9(n=238)	125	52.52	85	35.71	28	11.76
4	30-34.9(n=42)	2	04.76	15	35.71	25	59.52
5	≥35(n=22)	0	0.00	5	22.7	17	77.27

P value < 0.0001

The above table shows 78.7%of cases with BMI 18.5-24.9 belonged to HbA1c class of <5.6. Whereas 77.2%of cases with BMI ≥ 35 had HbA1C ≥6.5. This is statistically significant with P value of <0.0001.

Table 5: Distribution of cases according to waist circumference

S. No.	IDRS	Waist Circumference (in cm)							
		Male(n=300)				Female(n=200)			
		Normal <90cm (n=112)	%	Abnormal ≥90cm (n=188)	%	Normal <80cm (n=62)	%	Abnormal ≥80cm (n=138)	%
1	30-50 (n=150)	92	82.15	-	-	58	93.55	-	-
2	≥60 (n=350)	20	17.85	188	100.0	04	6.45	138	100.0

P value 0.001

The above table shows 100% of males with waist circumference≥90cm, and 100%females with waist circumference ≥80cm belonged to the IDRS class ≥60.Where as 82%male with WC<90cm & 93.55% of females with WC <80cm belonged to IDRS class of 30-50.This is statistically significant with P value 0.001.

Table 6: Distribution of cases according to waist circumference

S. No.	Waist Circumference (in cm)	HbA1C				
		<5.6 %		5.7-6.4 %		≥6.5 %
1	Male(n=300)	161	53.6	84	28.0	55 18.3
	Normal <90(n=112)	73	65.6	28	25	11 9
	Abnormal ≥90(n=188)	88	46.8	56	29.7	44 23.4
2	Female(n=200)	122	60	47	23.5	31 15.5
	Normal <80(n=62)	33	53.2	23	37.09	06 9.67
	Abnormal ≥80(n=138)	89	64.4	24	17.3	25 18.1

Chi-square: 2.628 , P value 0.2688

The above table shows HbA1C ≥6.5 is found in 23.4% (44) of male &18.1% (25) of females with abnormal waist circumference (≥90cm for male&≥80cm for female).

Table 7: Distribution of cases according to addiction

S. No.	Addiction	IDRS		No. of Cases	%
		30-50 (n=150) No. %	≥60 (n=350) No. %		
1	No Addiction (n=312)	78 25	234 75	312	62.4
2	Addiction (n=188)	72 38.2	116 61.7	188	37.6
a)	Tobacco	(33) 35.8	(59) 64.1	(92)	48.94
b)	Smoking	(16) 42.1	(22) 57.8	(38)	20.21
c)	Alcohol	(5) 35.7	(9) 64.2	(14)	7.45
d)	Tobacco + Smoking	(12) 42.8	(16) 57.1	(28)	14.89
e)	Tobacco + Alcohol + Smoking	(6) 37.5	(10) 62.5	(16)	8.51

P Value 0.675

The above table shows 62.4% of the cases had no history of addiction and 37.6%cases had history addiction to tobacco chewing, smoking or alcohol. IDRS ≥60 includes 75%cases without addiction and 61.7% cases with addiction. This is statistically insignificant.

Table 8: Distribution of cases according to physical activity

S. No.	IDRS	Physical Activity					
		No Exercise and Sedentary Work (n=248)	%	Exercise (Regular) or Strenuous works(n=198)	%	Exercise (Regular) + Strenuous works (n=54)	%
1	30-50 (n=150)	64	25.81	56	28.28	30	55.5
2	≥60 (n=350)	184	74.19	142	71.72	24	44.5

Chi-square: 19.148, P value < 0.0001

The above table shows 74.2% with light physical activity (no exercise and sedentary work) belonged to IDRS class ≥60.Where as 44.5%of cases doing regular exercise and strenuous work belonged to IDRS class ≥60.This is statistically significant.

Table 9: Distribution of cases according to physical activity

S. No.	Physical Activity	HbA1C				
		<5.6 % (n=283)		5.7-6.4 % (n=131)		>6.5 % (n=86)
1	No Exercise and Sedentary Work (n=248)	150	60.4	54	21.7	44 17.7
2	Exercise (Regular) or Strenuous work (n=198)	103	52.02	61	30.8	34 17.1
3	Exercise (Regular) + Strenuous work (n=54)	30	55.5	16	29.6	8 14.8

Chi-square: 5.327, P value 0.2553

The above table shows 60.4% of cases with light physical activity and 55.5% of cases with heavy physical activity had the HbA1C<5.6.And 17.7% cases with light physical activity and 14.8% of cases with heavy physical activity had the HbA1C >6.5. Among the detected 86 diabetic 44cases (51.1%) belonged to light physical activity (No Exercise and Sedentary Work). This is statistically insignificant.

Table 10: Distribution of cases according to hba1c

S. No.	IDRS	HbA1C					
		<5.6 (n=283)	%	5.7 – 6.4 (n=131)	%	≥6.5 (n=86)	%
1	**30-50 (n=150)**	115	40.6	19	14.5	16	18.6
2	**≥60 (n=350)**	168	59.3	112	85.4	70	81.39

P value< 0.0001

Among the 500 study cases 86 cases had HbA1c ≥ 6.5.81.39% of cases that is 70 of the detected 86 diabetic cases belonged to IDRS≥60. Indicating good sensitivity of test.

Table 11: Distribution of cases according to fasting plasma glucose

S. No.	IDRS	Fasting Plasma Glucose					
		<110mg/dl (n=368)	%	110-126 mg/dl (n=44)	%	>126mg/d (n=88)	%
1	30-50 (n=150)	131	35.5	03	6.8	16	18.1
2	≥60 (n=350)	237	64.5	41	93.1	72	81.8

P value < 0.0001

The above table shows, of the total 500 study cases 88 (17.6%) cases had the FBS>126mg/dl. Among these 88cases 72cases (81.8%) belonged to IDRS ≥60.And 44cases had FBS between 110-126mg/dl 41 cases (93.1%) within these belonged to IDRS≥60

Table 12: Distribution of cases according to two hours plasma glucose

S No	IDRS	2 Hours Plasma Glucose					
		<140 mg/dl (n=327)	%	140-199 mg/dl (n=83)	%	>200 mg/dl (n=90)	%
1	30-50 (n=150)	115	35.1	18	21.6	17	18.8
2	≥60 (n=350)	212	64.8	65	78.3	73	81.1

P value <0.0001

The above table shows 90 cases had 2h PG >200mg/dl. 73cases (81.1%) of these 90cases belonged to IDRS ≥60. This is statistically significant.

Table 13: Relation of various risk factors to IDRS score

S. No	Risk Factor	% of cases with IDRS ≥60
1	BMI ≥30	100%
2	WC (M≥90,F≥80)	100%
3	No Exercise Sedentary Work	74%

The above table shows how important are these risk factors as component of IDRS in screening of T2DM.All 66 cases with BMI>30 belonged to IDRS≥60. All cases with abnormal waist circumference had IDRS score≥60. 184 (74%) of the 248 cases with light physical activity had IDRS ≥60.

Distribution of newly detected diabetic patients (N=86) in reference to various variables (Table 14)

Table 14A: distribution of patients according to HBA1c

S. No.	*HbA_1C Range (%)	Number of Patients (n=86)	Percentage (%)
1	6.5 – 7.0	14	16.2
2	7.1 – 8.0	09	10.4
3	8.1 – 10	32	37.20
4	>10	31	36.04

Among the 86 detected diabetic 63 cases had HbA1C>8. Indicating higher blood sugar levels and delay in diagnosis of diabetes. This suggests need of good screening tool for early detection of diabetes.

Table 14B: Prevalence of neuropathy in newly detected diabetic patients

S. No.	Neuropathy	HbA_1C (%)			
		6.5-7.0 (n=14)	7.0-8.0 (n=09)	8.0-10 (n=32)	>10 (n=31)
1	Present (n=10)	-	-	04	06
2	Absent (n=76)	14	09	28	25

The prevalence of neuropathy in present study was 11.6% and was seen in cases with higher HbA1C levels**.**

Table 14C: Prevalence of nephropathy in newly detected diabetic patients

S. No.	Nephropathy	HbA_1C (%)			
		6.5-7.0 (n=14)	7.0-8.0 (n=09)	8.0-10 (n=32)	>10 (n=31)
1	Present(n=14)	-	01	06	07
2	Absent (n=72)	14	08	26	24

The nephropathy was found in 16.27% (14) of newly detected diabetic cases. The nephropathy was more prevalent among cases with higher HbA1C levels.

Table 14D: Prevalence of retinopathy in newly detected diabetic patients

S. No.	Retinopathy	HbA_1C (%)			
		6.5-7.0 (n=14)	7.0-8.0 (n=09)	8.0-10 (n=32)	>10 (n=31)
1	Present(n=12)	-	-	04	08
2	Absent (n=74)	14	09	28	23

The retinopathy was found in 13.9% (12) of newly detected diabetic cases. The retinopathy was more prevalent among a cases with higher HbA1C levels.

Table 15: Bistribution of newly detected diabetic patients according to past history

S. No.	Past History	IDRS	
		30-50 (n=16)	≥60 (n=70)
1	Absent(n=54)	16	38
2.	Present(n=32)	-	32
a)	Hypertension	-	20
b)	CAD	-	05
c)	CVA	-	01
d)	Others	-	06

Among 86 newly detected diabetic cases 20 cases had past history of Hypertension and 5 cases had past history of CAD 1 cases had past history of CVA.

5. Conclusion

The following inferences were drawn from the study

1. In present study 300 (60%) were male and 200 (40%) were female.
2. 70% of both male and female belonged to the IDRS of ≥60 and 30% belonged to risk score of 30-50.
3. In present study 76% of cases were literate and 24% were illiterate. Among the 76% of literate 83% were belonged to IDRS≥60.

4. 100% of cases with BMI >30, 95%of cases with BMI 25-29.9, 30.3% cases with BMI18.5-24.9 belonged to IDRS score≥60.
5. In present study 13% of male and 15.5% of female were obese, and 45% of male and 50.5% of female were overweight.
6. In this study 78.7%of cases with BMI 18.5-24.9 belonged to HbA1C<5.6.Where as 77.2%of cases with BMI ≥35 had HbA1C ≥6.5. This is statistically significant with P value of <0.0001.
7. 100% of male with waist circumference≥90cm, and 100%female with waist circumference ≥80cm belonged to the IDRS class ≥60.Where as 82%male with WC<90cm & 93.55% of female with WC <80cm belonged to IDRS class of 30-50.
8. HbA1C ≥6.5 was found in 23.4% (44) of male &18.1% (25) of female with abnormal waist circumference (≥90cm for male&≥80cm for female).
9. In present study 62.4% of the cases had no history of addiction and 37.6%cases had history addiction to tobacco chewing, smoking or alcohol. IDRS ≥60 included 75%cases without addiction and 61.7% cases with addiction. This was statistically insignificant.
10. In this study 74.2% with light physical activity (no exercise and sedentary work) belonged to IDRS class ≥60.Where as 44.5%of cases doing regular exercise and strenuous work belonged to IDRS class ≥60.This was statistically significant.
11. In this study 60.4% of cases with light physical activity and 55.5% of cases with heavy physical activity had the HbA1C<5.6.And 17.7% cases with light physical activity and 14.8% of cases with heavy physical activity had the HbA1C >6.5.Among the 86cases with HbA1C>6.5, 44 cases (51.1%) belonged to light physical activity (No Exercise and Sedentary Work).
12. In this study 88 cases had the FBS>126mg/dl. 90cases had 2hPG >200mg/dl. Both included 86 cases with HbA1C >6.5.
13. Among the 86 detected diabetic 63 cases had HbA1C>8. Neuropathy was found in 11.6%, nephropathy was found in 16.27%, retinopathy was found in 13.9% of the newly detected diabetic cases.
14. Among the 500 study cases 86 cases had HbA1C ≥ 6.5. 70 of the detected 86 diabetic cases belonged to IDRS≥60, indicating good sensitivity (81.39%) and moderate specificity of test (32.3%). Moreover, it proved to be cost effective screening test.

6. References

1. Joshi SR, Parikh RM. India - diabetes capital of the world: now heading towards hypertension. J Assoc Physicians India. 2007; 55:323-4.
2. Kumar A, Goel MK, Jain RB, Khanna P, Chaudhary V. India towards diabetes control: Key issues. Australas Med J. 2013; 6(10):524-31.
3. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes-estimates for the year 2000 and projections for 2030. Diabetes Care. 2004; 27(3):1047-53.
4. Whiting Dr, Guariguata L, Weil C, Shawj. IDF Diabetes atlas: Global estimates of the prevalence of diabetes for 2011 and 2030. Diabetes Res Clin Pract. 2011; 94:311-21
5. Bharti AV, Sandhya N, Vaz M. The development & characteristics of a physical activity questionnaire for epidemiological studies in urban middle class Indians, Indian Journal Medical Research 2000, 95-102.
6. Ghosh AT, Liu BMJ, Khoury BR. Valdez b Family History of Diabetes and Prevalence of the Metabolic Syndrome in U.S. Adults without Diabetes: 6-Year Results from the National Health and Nutrition Examination Survey (1999-2004) Public Health Genomics 2010; 13:353-359.
7. Hilding A, Eriksson AK, Agardh EE, Grill V, Ahlbom A, Efendic S. The impact of family history of diabetes and lifestyle factors on abnormal glucose regulation in middle-aged Swedish men and women diabetologia, 2006; 49:2589-2598.
8. Abdollahi A, Malekmadani M, Mansoori M, Bostak M, *et al.* Prevalence of diabetic retinopathy in patients with newly diagnosed type II diabetes mellitus Acta. MedicaIranica, 2006; 44(6):415.
9. Agrawal N, Sengar N, Jain P, Khare R. Nephropathy in newly diagnosed type 2 diabetics with special stress on role of hypertension. JAPI, 2011; 59(3):45.
10. Agrawal S, Raman R, Kumari RP, *et al.* Diabetic retinopathy in type-II diabetics detected by targeted screening versus newly diagnosed in general practice. Ann Acad Med Singapore 2006; 35(8):531.
11. Alvin C Powers. Diabetes mellitus. In Harison's principles of internal medicine, 18th ed. Longo *et al.* (eds). The McGraw Hill Companies, 2011, 2970.
12. Alvin C. Power Harrison's principle of Internal Medicine 17th edition 2008.
13. American Diabetes Association, Diagnosis and Classification of Diabetes Mellitus, Diabetes Care, 2004, 27-1.
14. American Diabetes Association: Diagnosis and classification of diabetes mellitus. Diabetes care. 2011; 34(1):S62-64.
15. American Diabetes Association: Standards of medical care in diabetes. Diabetes care. 2011; 34(1):S4.
16. Amini M, Amin Orroaya A, Safaei H, *et al.* Prevalence of diabetic retinopathy in newly diagnosed type-2 diabetic patients in Isfahan, Iran. Actaendocrinologica (BUC) 2008; 4(4):415-423.
17. Anand Vardhan, Adhikari Prabha MR, Kotian Shashidhar M, Nehasaxena, Sandhya Gupta, Amruta Tripathy The Value of the Indian Diabetes Risk Score as a Tool for Reducing the Risk of Diabetes, among Indian Medical Students Journal of Clinical and Diagnostic Research. 2011; 5(4):718-720.
18. Anjum Humayun, Arbab Sher Shah, Comparison of body mass index and waist circumference in predicting incident diabetes pak j physiol, 2010.
19. Arch G. Mainous III, Vanessa A. Diaz, Charles J. Everett Assessing Risk for Development of Diabetes in Young Adultsannals of family medicine, 2007, 5-5.
20. Athanasia Papazafiroplouou, Alexios Sotiropoulos, Eystathios Skliros, Marina Kardara, Anthi Kokolaki, Ourania Apostolou and Stavros Pappas Familial history of diabetes and clinical characteristics in Greek subjects with type 2 diabetes BMC Endocrine Disorders, 2009.