



ORIGINAL ARTICLE

Evidence Gap on the Prevalence of Non-conventional Risk Factors for Type 2 Diabetes in Iran

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Abstract

Objectives: Robust scientific evidence exists about the role of non-conventional risk factors in type 2 diabetes worldwide. The current epidemiological pattern of the disease in Iran suggests a precipitating role for these non-conventional risk factors. This review was performed to examine the research evidence suggesting a higher prevalence of non-conventional type 2 diabetes risk factors in Iran.

Methods: MeSH keywords were applied to search several databases, including PUBMED, MEDLINE, AMED, EMBASE, Iran DOC, and the Scientific Information Database without a time limit from inception to September 2011. The quality of the non-interventional and population-based studies on Iranians included in these databases was assessed by the authors and any disagreement was resolved with consensus.

Results: The literature search yielded 1847 publications, of which 62 were included in this study after eliminating non-relevant and overlapping papers. No study was found that verified a higher prevalence of the non-conventional type 2 diabetes risk factors in the Iranian population.

Conclusion: The identified evidence gap about the role of prominent non-conventional risk factors of type 2 diabetes in the Iranian population could be a major caveat in the application of an evidence-based approach to endorse or reject existing hypothesis about these risk factors. Studies on the prevalence of non-conventional biomarkers of type 2 diabetes among Iranians could be a promising area of research.

1. Introduction

Type 2 diabetes is a highly prevalent metabolic disorder and accounts for about 90% of all cases of diabetes

in the world [1]. The global prevalence of type 2 diabetes has reached 6.4%, which could be an overwhelming burden on the health and economies of countries [2]. Although there is robust scientific evidence about the role

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of conventional risk factors and, consequently, about effective preventive strategies to halt the progress of the disease worldwide, the marked increase in type 2 diabetes in recent decades represents a failure in putting the established science into practice [3].

The prevalence of type 2 diabetes among adult Iranians aged 25–64 years is estimated to be 7.7%, excluding undiagnosed patients [4]. Lifestyle changes, especially in urban areas, low rates of physical activity, and obesity are the main recognized conventional triggers in the occurrence of type 2 diabetes across the country [5]. The onset of the disease in Iran is currently mostly observable in the 45–55 year age group, whereas in the developed world it is mainly a disease of old age,

i.e., over the age of 65 years [6]. Such a difference may be due to a higher prevalence of conventional and non-conventional type 2 diabetes risk factors in Iran.

Lower plasma creatinine [7], a high intake of total and animal protein [8], plasma apelin and visfatin levels [9,10], lower β -cell function [11], plasma preptin levels (a hormone that is co-secreted with insulin and amylin from the pancreatic β cells) [12], serum 25-hydroxyvitamin D (25OHD), and dietary calcium [13–16] are a group of non-conventional risk factors that may explain the higher incidence and prevalence of type 2 diabetes in some ethnic groups.

This study was performed to look at the empirical research evidence about the studied risk factors for type 2

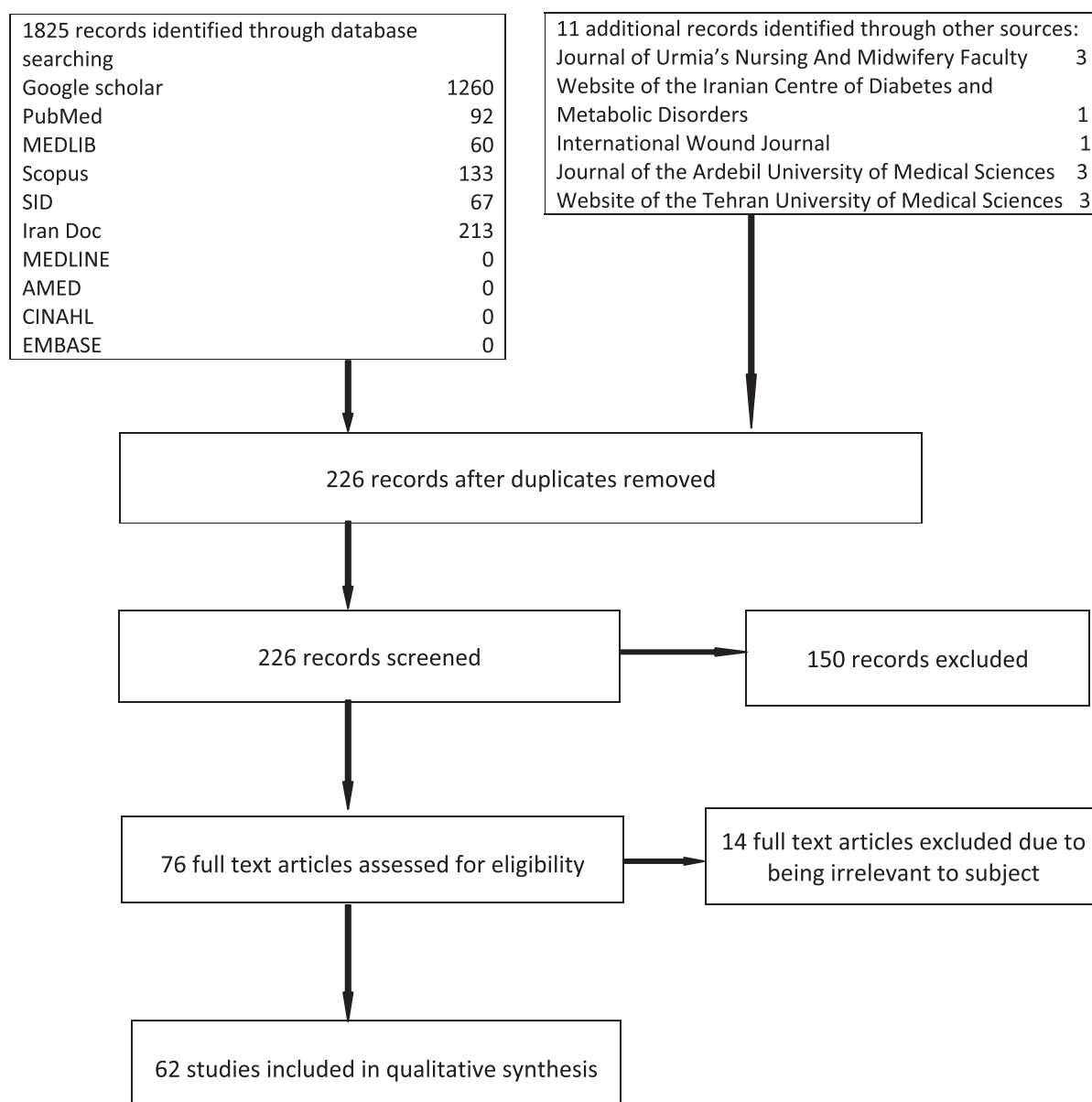


Figure 1. Flow diagram of the method of selecting publications on the risk factors of type 2 diabetes in Iran retrieved from databases.

diabetes in the Iranian population and to check whether there was any hypothesis to suggest a higher prevalence of non-conventional type 2 diabetes risk factors in Iran.

2. Materials and methods

In this systematic review, various keywords (including “type 2 diabetes”, “diabetes mellitus”, “maturity onset diabetes” or “noninsulin-dependent diabetes”, and “Iran” and “risk factor” with their Persian equivalents) were applied to search the PUBMED, MEDLINE, AMED, CINAHL, EMBASE, SCOPUS, and MEDLIB databases, and also the Scientific Information Database (SID; a national database of published articles in Iranian journals) and IRAN DOC (a database of published papers and thesis in Iran) without a time limit from inception to September 2011. The Super Searcher of Google Scholar was also checked for unpublished materials within the same time limit. All non-interventional population-based studies on Iranians living in Iran were included, but studies on people living in institutions, Iranians living abroad, and publications in non-English or non-Persian languages were excluded.

A customized data extraction sheet was used to extract and record the study data. The quality of the studies was determined based on the study design, sample size, sampling method, sampling frame, study feature, and a report of the type of conventional and non-conventional type 2 diabetes risk factors studied. The quality of the retrieved publications based on these quality criteria were assessed independently by the authors and any disagreement was resolved with consensus.

3. Results

We found 1836 publications in the first round of the search, along with 11 publications found through serendipitous discovery. The titles and abstracts of these identified publications were inspected and their relevance to the objective of this study was checked. As a result of overlaps among the scanned databases or inconsistencies with the study objectives, 1610 publications were excluded. Of the remaining publications (226), 150 papers were also excluded after they had been scrutinized in detail for inclusion and quality criteria. The full text of 76 publications were obtained at this stage and were studied thoroughly. Finally, 14 publications were excluded because they were not directly relevant to the study objectives. Consequently, 62 publications [17–74] were included in this review (Figure 1).

The risk factor most often studied in the selected publications was obesity and waist circumference; the least studied risk factors were polycystic ovary syndrome and the use of specific types of drugs, such as phenytoin

(Dilantin), diuretics (thiazides), corticosteroids, beta blockers, and steroids (contraceptives; Table 1). The applied cutoff points to assign abnormality in the retrieved studies are given in Table 2. Data about the year of publication of the included publications are given in Table 3.

We found no study focused on the prevalence of non-conventional type 2 diabetes risk factors in the Iranian population, nor any hypothesis explaining a probable higher prevalence of non-conventional risk factors for type 2 diabetes.

4. Discussion

The findings of this study revealed a major gap in the study of prominent non-conventional risk factors for type 2 diabetes in the Iranian population. Obesity and waist circumference were among the most frequently studied risk factors that have been screened as predictors of type 2 diabetes in Iran. Inconsistency in the applied cutoff points of the studied risk factors compared with internationally agreed recommendations was noticeable in these studies [75]. To the best of our knowledge, this is the first systematic review investigating scientific evidence about the prevalence of non-conventional risk factors of type 2 diabetes in Iran. Although there is empirical research evidence suggesting that identified non-conventional type 2 diabetes risk factors might play a part in the incidence of the disease [76–78], no research evidence was identified to endorse or reject a higher prevalence of non-conventional type 2 diabetes risk factors in Iran. This should be considered as a major caveat in the application of an evidence-based approach

Table 1. Studied risk factors of type 2 diabetes in the Iranian studies retrieved from databases.

Risk factor	No. (%) of publications
Obesity and waist size	51 (82.1)
Hypertension	25 (40.3)
Dislipidemia	25 (40.3)
Old age	20 (32.2)
Female sex	14 (22.5)
Family history	14 (22.5)
Lifestyle	13 (20.9)
Smoking	11 (17.7)
Urbanization	6 (9.6)
Waist to hip ratio	6 (9.6)
Educational level	4 (6.4)
Stress and anxiety	4 (6.4)
Frequent pregnancies	3 (4.8)
Waist to height ratio	2 (3.2)
Polycystic ovary syndrome	1 (1.6)
Use of some drugs ^a	1 (1.6)

^aPhenytoin (Dilantin), diuretics (thiazides), corticosteroids, beta blockers, and steroids (contraceptives).

Table 2. Cutoff point applied to indicate a higher risk of type 2 diabetes in the Iranian studies retrieved from databases.

Obesity	BMI > 25 kg/m ²
Waist size	> 102 cm in men and > 88 cm in women
Hypertension	Systolic blood pressure > 140 mmHg and diastolic blood pressure > 90 mmHg
Dislipidemia	
Triglycerides	> 150 mg/dL (1.69 mmol/L)
HDL cholesterol	< 40 mg/dL (1.03 mmol/L)
Total cholesterol	> 200 mg/dL (5.17 mmol/L)
Old age	> 65 years
Waist to hip ratio	> 0.9 in me and > 0.8 in women
Waist to height ratio	> 0.5

BMI = body mass index; HDL = high-density lipoprotein.

in preventive and interventional programs to mitigate the burden of the disease.

Selection bias due to limited accessibility to all the relevant international databases, a lack of access to published work in Iran due to the absence of an integrated database of scientific publications, and inclusion criteria of selecting only publications in the English and Persian languages were major methodological sources of bias in this review. Therefore the study results must be considered with caution.

The findings of this study, regardless of the inherent limitations, highlight a major gap in studying the epidemiology of type 2 diabetes in Iran and demonstrated the inadequacy of scientific evidence to precisely explain the triggering factors for the epidemic in the country. The paucity of scientific evidence to inform the national type 2 diabetes care protocol may explain and even broaden the current identified gaps in the Iranian type 2 diabetes care protocol [79]. As a promising area of study, we invite researchers to work on the prevalence of the prevailing

Table 3. Year of the publication of the Iranian studies on the risk factors of type 2 diabetes retrieved from databases.

Year of publication	No. (%) of publications
2011–2010	17 (27.4)
2009–2008	25 (40.0)
2007–2005	9 (14.5)
2004–2000	9 (14.5)
1999–1995	2 (3.2)

non-conventional type 2 diabetes biomarkers and also on any hypothetical non-identified biomarker that could potentially clarify whether any non-conventional type 2 diabetes risk factors may explain the current expanding pattern of the disease in Iran.

Conflicts of interest

The authors declare no competing or conflict of interests.

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References

1. Funnell MM, Brown TL, Childs BP, et al. National standards for diabetes self-management education. *Diabetes care* 2008 Jan; 31(Suppl. 1):S97–104.
2. Herman WH, Zimmet P. Type 2 diabetes: an epidemic requiring global attention and urgent action. *Diabetes Care* 2012 May; 35(5):943–4.
3. Danaei G, Finucane MM, Lu Y, et al. National, regional, and global trends in fasting plasma glucose and diabetes prevalence since 1980: systematic analysis of health examination surveys and epidemiological studies with 370 country-years and 2.7 million participants. *Lancet* 2011 Jul;378(9785):31–40.
4. WHO. Country and regional data on diabetes, Prevalence of diabetes in the WHO Eastern Mediterranean Region; 2014, http://www.who.int/diabetes/facts/world_figures/en/index2.html [accessed 10.02.13].
5. Ministry of Health and Medical Education of Islamic Republic of Iran. Preventing from diabetes 2011; 2010, <http://iec.behdasht.gov.ir> [accessed 24.07.13].
6. Harati H, Hadaegh F, Saadat N, et al. Population-based incidence of Type 2 diabetes and its associated risk factors: results from a six-year cohort study in Iran. *C Public Health* 2009 Jun;16(9): 186.
7. Peter A, Fritsche A, Machicao F, et al. Lower plasma creatinine and urine albumin in individuals at increased risk of type 2 diabetes with factor v Leiden mutation. *ISRN Endocrinol*; 2014 Mar. <http://dx.doi.org/10.1155/2014/530830>.
8. van Nielen M, Feskens EJ, Mensink M, et al. Dietary protein intake and incidence of type 2 diabetes in Europe: the EPIC-INTERACT case-cohort study. *Diabetes Care* 2014 Jul;37(7): 1854–62.
9. Ma WY, Yu TY, Wei JN, et al. Plasma apelin: a novel biomarker for predicting diabetes. *Clin Chim Acta* 2014 Aug 5;435:18–23.
10. Li L, Yang G, Li Q, et al. Changes and relations of circulating visfatin, apelin, and resistin levels in normal, impaired glucose tolerance, and type 2 diabetic subjects. *Exp Clin Endocrinol Diabetes* 2006 Nov;114(10):544–8.
11. Kanaya AM, Herrington D, Vittinghoff E, et al. Understanding the high prevalence of diabetes in U.S. South Asians compared with four racial/ethnic groups: the MASALA and MESA studies. *Diabetes Care* 2014 Jun;37(6):1621–8.
12. Yang G, Li L, Chen W, et al. Circulating preptin levels in normal, impaired glucose tolerance, and type 2 diabetic subjects. *Ann Med* 2009;41(1):52–6.

13. Gagnon C, Lu ZX, Magliano DJ, et al. Serum 25-hydroxyvitamin D, calcium intake, and risk of type 2 diabetes after 5 years: results from a national, population-based prospective study (the Australian Diabetes, Obesity and Lifestyle study). *Diabetes Care* 2011 May;34(5):1133–8.
14. Hurskainen AR, Virtanen JK, Tuomainen TP, et al. Association of serum 25-hydroxyvitamin D with type 2 diabetes and markers of insulin resistance in a general older population in Finland. *Diabetes Metab Res Rev* 2012 Jul;28(5):418–23.
15. Forouhi NG, Ye Z, Rickard AP, et al. Circulating 25-hydroxyvitamin D concentration and the risk of type 2 diabetes: results from the European Prospective Investigation into Cancer (EPIC)-Norfolk cohort and updated meta-analysis of prospective studies. *Diabetologia* 2012 Aug;55(8):2173–82.
16. Buijsse B, Boeing H, Hirche F, et al. Plasma 25-hydroxyvitamin D and its genetic determinants in relation to incident type 2 diabetes: a prospective case-cohort study. *Eur J Epidemiol* 2013 Sep;28(9):743–52.
17. Esteghamati A, Meysamie A, Khalilzadeh O, et al. Third national surveillance of risk factors of non-communicable diseases (SuRFNCD-2007) in Iran: methods and results on prevalence of diabetes, hypertension, obesity, central obesity, and dyslipidemia. *BMC Public Health*; 2009 May 29. <http://dx.doi.org/10.1186/1471-2458-9-167>.
18. Rastravan H. Prevalence of obesity and its relation with the prevalence of type 2 diabetes in Lahijan. Pahrn D thesis. Faculty of Pharmacy: Tehran Univesity of Medical Sciences; 1996.
19. Hadaegh F, Shafiee G, Azizi F. Anthropometric predictors of incident type 2 diabetes mellitus in Iranian women. *Ann Saudi Med* 2009 May–Jun;29(3):194–200.
20. Fakhzadeh H, Bandarian F, Adibi H, et al. Coronary heart disease and associated risk factors in Qazvin: a population-based study. *East Mediterr Health J* 2008 Jan–Feb;14(1):33–41.
21. Sadeghi M, Roohafza H, Shirani S, et al. Diabetes and associated cardiovascular risk factors in Iran: the Isfahan Healthy Heart Programme. *Ann Acad Med Singapore* 2007 Mar;36(3):175–80.
22. Amini M, Janghorbani M. Diabetes and impaired glucose regulation in first-degree relatives of patients with Type 2 diabetes in Isfahan, Iran: prevalence and risk factors. *Rev Diabet Stud* 2007 Fall;4(3):169–76.
23. Hadaegh F, Hatami M, Tohidi M, et al. Lipid ratios and appropriate cut off values for prediction of diabetes: a cohort of Iranian men and women. *Lipids Health Dis*; 2010 Aug 17. <http://dx.doi.org/10.1186/1476-511X-9-85>.
24. Hosseinpanah F, Rambod M, Azizi F. Population attributable risk for diabetes associated with excess weight in Tehranian adults: a population-based cohort study. *BMC Public Health* 2007 Nov 14; 7:328.
25. Bozorgmanesh M, Hadaegh F, Azizi F. Predictive performance of the visceral adiposity index for a visceral adiposity-related risk: type 2 diabetes. *Lipids Health Dis*; 2011 May 27. <http://dx.doi.org/10.1186/1476-511X-10-88>.
26. Azimi-Nezhad M, Ghayour-Mobarhan M, Parizadeh MR, et al. Prevalence of type 2 diabetes mellitus in Iran and its relationship with gender, urbanisation, education, marital status and occupation. *Singapore Med J* 2008 Jul;49(7):571–6.
27. Haghdoost AA, Rezazadeh-Kermani M, Sadghirad B, et al. Prevalence of type 2 diabetes in the Islamic Republic of Iran: systematic review and meta-analysis. *East Mediterr Health J* 2009 May–Jun;15(3):591–9.
28. Harati H, Hadaegh F, Momenan AA, et al. Reduction in incidence of type 2 diabetes by lifestyle intervention in a Middle Eastern community. *Am J Prev Med* 2010 Jun;38(6): 628–36.
29. Sajjadi F, Mohammadifard N, Kelishadi R, et al. Clustering of coronary artery disease risk factors in patients with type 2 diabetes and impaired glucose tolerance. *East Mediterr Health J* 2008 Sep–Oct;14(5):1080–9.
30. Janghorbani M, Amini M. Metabolic syndrome in type 2 diabetes mellitus in Isfahan, Iran: prevalence and risk factors. *Metab Syndr Relat Disord* 2007 Sep;5(3):243–54.
31. Moayeri H, Rabbani A, Keihanidoust ZT, et al. Overweight adolescents: a group at risk for metabolic syndrome (Tehran adolescent obesity study). *Arch Iran Med* 2008 Jan;11(1):10–5.
32. Esteghamati A, Gouya MM, Abbasi M, et al. Prevalence of diabetes and impaired fasting glucose in the adult population of Iran: National Survey of Risk Factors for Non-Communicable Diseases of Iran. *Diabetes Care* 2008 Jan;31(1):96–8.
33. Mirzaei F, Kazemi N. Prevalence of polycystic ovary syndrome in women with type 2 diabetes in Kerman, Iran. *Metab Syndr Relat Disord* 2008 Sep;6(3):215–7.
34. Amini M, Horri N, Farmani M, et al. Prevalence of polycystic ovary syndrome in reproductive-aged women with type 2 diabetes. *Gynecol Endocrinol* 2008 Aug;24(8):423–7.
35. Hadaegh F, Zabetian A, Harati H, et al. The prospective association of general and central obesity variables with incident type 2 diabetes in adults, Tehran lipid and glucose study. *Diabetes Res Clin Pract* 2007 Jun;76(3):449–54.
36. Esteghamati A, Ashraf H, Khalilzadeh O, et al. Trends of diabetes according to body mass index levels in Iran: results of the national Surveys of Risk Factors of Non-Communicable Diseases (1999–2007). *Diabet Med* 2010 Nov;27(11):1233–40.
37. Derakhshan R, Khoshnood A, Balace P. Evaluation of abdominal obesity prevalence in diabetic patients and relation with other factors of metabolic syndrome. *Iran J Endocrinol Metab* 2010; 12(3):208–12.
38. Safaei H, Amini M. Quality of control and treatment of blood pressure in type 2 diabetes patient with hypertension. *Iran J Endocrinol Metab* 2007;9(3):235–41.
39. Hadaegh F, Harati H, Azizi F. The effect of impaired fasting glucose and impaired glucose tolerance in prediction of incident type 2 diabetes: Tehran Lipid and Glucose Study. *Iran J Endocrinol Metab* 2006;7(4):293–300 [In Persian].
40. Amini M, Horri N, Farmani M, et al. Annual and 5-year incidence rate of hypertension in type 2 diabetic patients. *Iran J Endocrinol Metab* 2006;4(3):173–7 [In Persian].
41. Sharifi F, Mirarefin M, Fakhzadeh H, et al. Prevalence of hypertension and diabetes in elderly residents of Kahrizak. *Salmand Iran J Ageing* 2009;4(11):16–29 [In Persian].
42. Mazloomi S, Mirzaei A, Afkhami Ardakani M, et al. The role of health beliefs in preventive behaviors of individuals at high-risk of type2 diabetes mellitus. *J Shaheed Sadoughi Univ Med Sci* 2010;18(1):24–31 [In Persian].
43. Ahmadi A, Hasanzadeh J, Ghaem H, et al. The survey of family history of diabetes in patients with type 2 diabetes in Chaharmahal va Bakhteyari province, Iran, 2008. *J Shahrekord Univ Med Sci* 2009;11(2):1–7 [In Persian].
44. Rostambeigi N, Shaw JE, Atkins RC, et al. Waist circumference has heterogeneous impact on development of diabetes in different populations: longitudinal comparative study between Australia and Iran. *Diabetes Res Clin Pract* 2010 Apr;88(1): 117–24.
45. Ebrahimipour P, Fakhzadeh H, Heshmat R, et al. Metabolic syndrome and menopause: a population-based study. *Diabetes Metab Syndr* 2010 Jan–Mar;4(1):5–9.
46. Soltanian A, Bahreini F, Afkhami-Ardekani M. People awareness about diabetes disease and its complications among aged 18 years and older in Bushehr port inhabitants (Iran). *Diabetes Metab Syndr* 2007 Dec;1(4):245–9.
47. Rambod M, Hosseinpanah F, Ardakani EM, et al. Fine-tuning of prediction of isolated impaired glucose tolerance: a quantitative clinical prediction model. *Diabetes Res Clin Pract* 2009 Jan; 83(1):61–8.
48. Janghorbani M, Amini M. Hypertension in type 2 diabetes mellitus in Isfahan, Iran: Incidence and risk factors. *Diabetes Res Clin Pract* 2005 Oct;70(1):71–80.

49. Hadaeigh F, Shafiee G, Ghasemi A, et al. Impact of metabolic syndrome, diabetes and prediabetes on cardiovascular events: Tehran Lipid and Glucose Study. *Res Clin Pract* 2010 Mar;87(3):342–7.
50. Hosseinpanah F, Rambod M, Azizi F. Likelihood of having isolated postchallenge hyperglycemia in an Iranian urban population. *Diabetes Res Clin Pract* 2008 Mar;79(3):490–6.
51. Amini M, Afshin-Nia F, Bashardoost N, et al. Prevalence and risk factors of diabetes mellitus in the Isfahan city population (aged 40 or over) in 1993. *Diabetes Res Clin Pract* 1997 Dec;38(3):185–90.
52. Azizi F, Salehi P, Etemadi A, et al. Prevalence of metabolic syndrome in an urban population: Tehran Lipid and Glucose Study. *Diabetes Res Clin Pract* 2003 Jul;61(1):29–37.
53. Esteghamati A, Ashraf H, Rashidi A, et al. Waist circumference cut-off points for the diagnosis of metabolic syndrome in Iranian adults. *Diabetes Res Clin Pract* 2008 Oct;82(1):104–7.
54. Esteghamati A, Khalilzadeh O, Rashidi A, et al. Association between physical activity and insulin resistance in Iranian adults: national surveillance of risk factors of non-communicable diseases (SuRFNCD-2007). *Prev Med* 2009 Nov;49(5):402–6.
55. Jahanlou SH, Ghofranipour F, Kimmiagar M, et al. The relationship between knowledge, self-efficacy and quality of life with blood glucose and lipids level control among smoker diabetic patients. *Hormozgan Med J* 2007;11(4):261–6 [In Persian].
56. Kalantar Hormozi MR, Siadatan SJ, Aria A, et al. Risk factors of diabetes mellitus in Shiraz. *Iran J Diabetes Lipid Disord* 2008 Winter;7(2(23)):159–66 [In Persian].
57. Hadaeigh F, Bozorgmanesh MR, Ghasemi A, et al. High prevalence of undiagnosed diabetes and abnormal glucose tolerance in the Iranian urban population: Tehran Lipid and Glucose Study. *BMC Public Health*; 2008 May 24. <http://dx.doi.org/10.1186/1471-2458-8-176>.
58. Najafipour F, Azizi F, Zareeizadeh M. Epidemiological study of familial diabetes type 2 in Tehran. *Iran J Diabetes Lipid Disord* 2004 Fall;4(1):35–42.
59. Safaei H, Amini M, Behrouz ZH, et al. Cardiovascular risk factors in patients with newly diagnosed type 2 diabetes. *Iran J Endocrinol Metab* 2006 Spring;8(1(SN 29)):31–8.
60. Bonakdaran SH, Taghavi M. Cardiovascular Risk Factors in Type 2 Diabetic Patients in Mashhad City. *Iran J Endocrinol Metab* 2010 May;12(1 (SN 49)):1–6.
61. Afkhami Ardekani M, Rashidi M. Type 2 diabetes and its risk factors. *J Rafsanjan Univ Med Sci* 2006 Winter;4(4-B (17)):348–65.
62. Vazifeh Asl M, Nanbakhsh ZH, Mehdinejad R, et al. Incidence of obesity, hyperlipidaemia and hyperglycaemia in NIDDM patients of the Urmia diabetes center. *J Urmia Nurs Midwifery Fac* 2006;4(3):112–6 [In Persian].
63. Ghaderpanahi M, Fakhrzadeh H, Sharifi F, et al. Association of physical activity with risk of type 2 diabetes. *Iranian J Publ Health* 2011;40(1):86–93.
64. Razavi S, Zare H, Esfandy H. Diabetes risk factors in referent patients to center of diabetes control in Yazd city. *Tehran Univ Med J* 1999;57(1):72–7.
65. Motarefi H, Sedghi N, Azarpeik J, et al. A survey on the prevalence of diabetes risk factors among the patients of diabetes clinic of Khoy 2009. Paper presented at: 1st National Congress on Nursing of diabetes; 2010 Nov 9–11. Zabol, Iran, <http://www.nosabooks.com/webui/book.aspx?simorgh=1&marckey=1573691&marckind=3>.
66. Sepanlou SG, Kamangar F, Poustchi H, et al. Reducing the burden of chronic diseases: a neglected agenda in Iranian health care system, requiring a plan for action. *Arch Iran Med* 2010 Jul;13(4):340–50.
67. Abtahi F, Naghshzan A, Zibaenezhad MJ, et al. The relationship between body mass index and pre-diabetes in teachers residing in Shiraz-Iran 2009. *Iran Cardiovasc Res J* 2010;4(3):112–7.
68. Lankarani M, Zahedi F. Primary prevention of type 2 diabetes mellitus. *Iran J Diabetes Metab* 2002;1(2):87–106.
69. Kelishadi R, Amirkhani A, Ardalan G, et al. An overview of a national surveillance program in Iran for prevention of chronic non-communicable diseases from childhood: CASPIAN Study. *Iranian J Publ Health* 2009;38(Suppl. 1):102–6.
70. Asgari F, Aghajani H, Haghazali M, et al. Non-communicable diseases risk factors surveillance in Iran. *Iranian J Publ Health* 2009;38(Suppl. 1):119–22.
71. Namayandeh SM, Sadr SM, Ansari Z, et al. Cross-sectional study of the prevalence of coronary artery disease traditional risk factors in Yazd urban population, Yazd Healthy Heart Project. *Iran Cardiovasc Res J* 2011;5(1):7–13.
72. Esteghamati A, Rashidi A. Current status of non-communicable diseases in Iran: evidence gaps being filled; 2014, <http://www.athero.org/commentaries/comm921.asp> [accessed 05.06.14].
73. Ghavami H, Ahmadi F, Meamarian R, et al. Effectiveness of applying continuous care model on diabetic patients body mass index and weight. *Horizon Med Sci* 2006;12(2):10–6 [In Persian].
74. Alikhani S, Delavari A, Alaadini F, et al. A province-based surveillance system for the risk factors of non-communicable diseases: a prototype for integration of risk factor surveillance into primary healthcare systems of developing countries. *Public Health* 2009 May;123(5):358–64.
75. International Diabetes Federation. The IDF consensus worldwide definition of the metabolic syndrome; 2011, http://www.idf.org/webdata/docs/IDF_Metasybdrome_definition.pdf [accessed 12.05.13].
76. Chatterjee R, Brancati FL, Shafi T, et al. Non-traditional risk factors are important contributors to the racial disparity in diabetes risk: the atherosclerosis risk in communities study. *J Gen Intern Med* 2014 Feb;29(2):290–7.
77. Ye X, Zong G, Liu X, et al. Development of a new risk score for incident type 2 diabetes using updated diagnostic criteria in middle-aged and older Chinese. *PLoS ONE* 2014;9(5). <http://dx.doi.org/10.1371/journal.pone.0097042>.
78. Bennet L, Groop L, Franks PW. Ethnic differences in the contribution of insulin action and secretion to type 2 diabetes in immigrants from the Middle East compared to native Swedes. *Diabetes Res Clin Pract*; 2014 Apr 28. <http://dx.doi.org/10.1016/j.diabres.2014.04.025>.
79. Shaghghi A, Ahmadi A, Pourememali F. Plugging gaps in the Iranian type-2 diabetes care protocol: analysis of knowledge evidence. *Int J Diabetes Res* 2014;3(2):11–4.