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ORIGINAL RESEARCH

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Prevalence of diabetes and its correlates among Iranian adults: Results of the first phase of Shahedieh cohort study

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Abstract

Background and Aims: The diabetes is one of the most common noncommunicable diseases, the prevalence of which is increasing worldwide. This study aimed to determine the prevalence, and correlates the factors of diabetes in the setting of Shahedieh cohort study in Yazd, Iran.

Method: The present study is a cross-sectional study conducted on the data of the initial stage of Shahdieh Yazd cohort. This study examined the data of 9747 participants aged from 30 to 73 years. The data included demographic, clinical, and blood test variables. Multivariable logistic regression was used to calculate the adjusted odds ratio (OR), and the risk factors of diabetes were studied. Meanwhile, population attributable risks for diabetes were estimated, and reported.

Results: The prevalence of diabetes was 17.9% (CI95%: 17.1–18.9); 20.5% in women, and 15.4% in men. Based on the results of multivariable logistic regression showed female sex (OR = 1.4, CI95%: 1.24–1.58), waist-hip ratio (OR = 1.4, CI95%: 1.24–1.58), high blood pressure (OR = 2.1, CI95%: 1.84–2.4), cardiovascular diseases (CVD) (OR = 1.52, CI95%: 1.28–1.82), stroke (OR = 1.91, CI95%: 1.24–2.94), age (OR = 1.81, CI95%: 1.67–1.96), hypercholesterolemia (OR = 1.79, CI95% triglyceride: 1.59–2.02), and low-density lipoprotein (LDL) (OR = 1.45, CI95%: 1.4–1.51), as risk factors for diabetes. Among the modifiable risk factors, high blood pressure(52.38%), waist-to-hip ratio (48.19%), the history of stroke (47.64%), hypercholesterolemia (44.13%), history of CVD (34.21%), and LDL ≥ 130 (31.03%) had the greatest population-attributable, respectively.

Conclusion: The results showed that some of the main determinants of diabetes are the modifiable risk factors. Therefore, implementing early detection, and screening programs for people at risk and preventive measures, such as lifestyle modification programs, and control of risk factors can prevent this disease.

KEYWORDS

cardiovascular diseases, diabetes, diabetes risk factors, epidemiological study, prevalence, type 2

1 | BACKGROUND

Diabetes mellitus (DM) is considered one of the most common chronic diseases, and one of the most challenging health problems in the world in the 21st century.[1] A common effect of uncontrolled diabetes is severe damage to many body systems, especially the nerves, and blood vessels. Based on the estimates from Global Burden of Disease Study, 2019, diabetes is the eighth leading cause of death, and disability worldwide, affecting nearly 460 million people worldwide—in every country and age group—live with this disease, and it has led to a significant burden on the health systems.[2]

Based on the estimate of International Diabetes Federation, the number of people with diabetes will reach 642 million people by 2040.[3] The prevalence of diabetes in different ethnic groups worldwide was reported to be from 7.8% to 15.5%.[4] There are various statistics on diabetes in Iran.

Based on World Health Organization reported in 2020, the overall prevalence of diabetes in Iran is 10.3%, which is estimated at 9.6% and 11.1% in men and women, respectively.[5] The prevalence of diabetes in Yazd province was 16.3%.[6] This disease is caused by the combination of genetic and environmental factors.[7] The occurrence of rapid, and significant changes in the way of life in many countries has increased the prevalence of obesity and other noncommunicable disease risk factors.[8] Common risk factors of disease include overweight, obesity, low physical activity, high fat consumption, low fiber diet, race, family history, age, low birth weight, smoking, and blood pressure.[9–11] DM is one of the biggest health care issues in Yazd province in terms of its prevalence, costs and consequences in the life of a person, considering that diabetes can be controlled and prevented. Furthermore, different and preventable factors, including the factors related to lifestyle play a role in the early onset of type 2 diabetes. Identifying these risk factors and determining the role of each of them and intervention based on it can be considered basic steps in the management of diabetes and its complications. This study aimed to determine the prevalence, and determinants of diabetes in the setting of the Shahedieh cohort study in Yazd, Iran.

2 | METHOD

2.1 | Study design and population

The current cross-sectional study was conducted using the data of the first stage of Yazd Shahedieh cohort on the population aged from 30 to 73. This study is part of PERSIAN, Prospective Epidemiological Research Studies in Iran conducted in 2016 to survey noncommunicable diseases, including diabetes, and the related risk factors in Shahedieh area of Yazd.[12] This area was selected based on the conditions, such as the availability of people, lack of migration to other cities, almost identical and untouched ethnicity, and the cooperation of local people. The inclusion criteria of study were the age of 30–73 years, permanent residence in mentioned district over the last 9 months, continuously, and willingness to participate in the study.

In summary, using the regional records, the population census of study area was created (the total population of Shahdieh city of Yazd is 17,000 people). Based on the census, trained personnel went door to door to first confirm the presence of people with the age conditions of study (men and women aged 30–73 years), and then provide them with the explanations about the study along with information pamphlets. The door-to-door method was chosen because a face-to-face invitation is more effective in Iranian culture, and improves participation. If subjects agreed to participate, they were later contacted by telephone to schedule an appointment at the cohort center. Thus, the information collected by a trained cohort team. Informed consent for illiterate participants was obtained from their legally authorized representatives. Finally, 9747 participants aged 30–73-year-old were investigated.

From all participants in the evidence study, demographic information, behavioral information, and lifestyle-related information were evaluated via the valid questionnaires. Anthropometric indices and blood pressure were measured for all people, and blood samples were taken from eligible people.

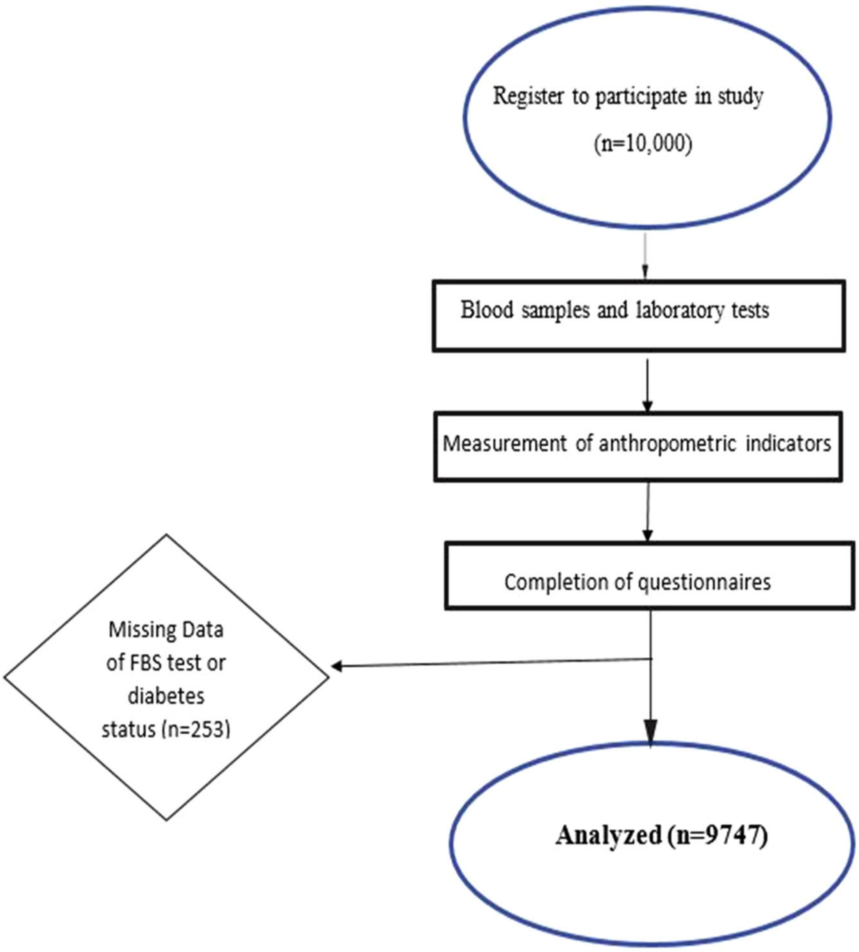
2.2 | Data collection

Data on 9747 people were collected using the questionnaires, clinical examinations, blood tests, and paraclinical tests. Variables include the demographic characteristics (age, sex, and education level), socio-economic characteristics, the history of chronic diseases (diabetes, blood pressure, cardiovascular diseases [CVD], stroke, heart attack), anthropometric indicators (body mass index [BMI], ratio of waist circumference to hips), along with blood lipid disorders and smoking was extracted and used from the Shahedieh cohort study (Figure 1). The participants who smoked daily, occasionally in the past or during the experiment (using at least 100 cigarettes a lifetime) were considered smokers.[13,14]

2.3 | Measures

BMI was calculated by dividing weight (kilograms) by the square of height (meters). People with a BMI less than 25 were classified as normal; those with a BMI between 25 and 30 were classified as overweight; and those with a BMI greater than 30 were classified as obese. The waist/hip ratio was calculated by dividing the size of waist to the hips by centimeters. A waist-to-hip ratio greater than 0.95 for men, and greater than 0.90 for women was considered undesirable.[15] The diabetes was defined as fasting blood sugar above 126 or using hypoglycemic drugs. Hypertension was defined as systolic blood pressure ≥140 mmHg or DBP ≥ 90 mmHg and/or the use of antihypertensive drugs. Glyceride greater than or equal to 150 mg/dL (triglyceride [TG] ≥ 200 mg/dL) and cholesterol greater than or equal to 240 mg/dL (cholesterol ≥240 mg/dL) and low-density lipoprotein (LDL) greater than or equal to 130 mg/dL (LDL ≥ 130 mg/dL) were considered as abnormal values. Thus, high-density lipoprotein (HDL) values less than 35 mg/dL (HDL ≤ 35 mg/

FIGURE 1 Flowchart of study.



dL) were considered abnormal HDL values.[12,16] People who smoked daily (or at least 100 cigarettes in their lifetime) were classified as smokers 17.[17]

2.4 | Statistical analysis

Statistical analyses were performed using SPSS Version 24 software. Qualitative data were reported as numbers and percentages, and quantitative data were reported as the mean, and standard deviation. To estimate the severity of the effect of diabetes risk factors, an adjusted odds ratio (OR adjusted) was used.

In the first step, we check the multicollinearity of study variables with variance inflation factor values, and no collinearity was observed among the variables. A univariate logistic regression analysis was used to calculate the OR, and identify the risk factors of diabetes. In the next step, variables with $p \le 0.2$ were enrolled in the multivariable logistic backward technique to identify the involved variables. In this model, the dependent variable was diabetes, and people without the disease were considered the reference class. Each risk factor's effect size (OR) was calculated with a 95% confidence interval (CI), and a p value of less than 0.05 was considered statistically significant. Finally, we used Chi-square goodness of fit test and deviance to get at how well final model fits the data. We examined the collinearity with the regression model, and no collinearity was observed among the variables.

The population attributable risk (PAF) was estimated using following formula[18]:

$$\%AR_{pop} = \frac{Pe(OR - 1)}{1 + Pe(OR - 1)} \times 100$$

OR is the OR of the risk factor calculated using the multivariate logistic regression analysis, and P_e is the ratio of the population exposed to the risk factor. The upper and lower limits (CI95%) for AR were calculated by SAS Version 9.1 (SAS Institute, Cary, NC).

2.5 | Ethics approval and consent to participate

The ethical considerations of study, such as the objectives of the study, the method of conducting the study and confidentiality of information were fully explained to the participant. After providing informed consent, the participants were given questionnaires and then examined. The study protocol was consistent with the ethical principles of the Helsinki Declaration. Research Ethics Committee approved it of Yazd University of Medical Sciences with Ethical ID IR.SSU.SPH.REC. 1400.029.

3 | RESULTS

This study included 9747 people ranging in age from 30 to 73, with an average age of 48.4 ± 9.58. Regarding sex, 50.1% were men, and 49.9% were women. Regarding sex, 50.1% were men, and 49.9% were women. 44.2% were employed, and 8.8 95% of people were married. Regarding education, 16.6% were illiterate, 31.3% elementary, 16.6% middle school, 20.2% diploma, 3.9% postgraduate, 9.6% bachelor, 1/2% had a master's degree or higher. The average BMI was 28.4 ± 4.87, and the average WHR was 93 ± 0.07. The average blood serum cholesterol, LDL, HDL, and TG were 189.7, 103.9, 52.7, and 166.3 mg/dL, respectively. The prevalence of blood pressure, heart diseases, and smoking was 21.2% and 8%, and 22.6%. Furthermore, the prevalence of diabetes was 17.9% (CI95%: 17.1–18.9) in the whole population and 20.5% in women, and 15.4% in men. Moreover, the average age group of people with diabetes was higher than healthy people ($p < 0.001$) (Table 1).

The findings of the univariate analysis revealed a significant association ($p = 0.05$) between diabetes in the firm and age, sex, education, BMI, waist-to-hip ratio, smoking, high blood pressure, TG, LDL, HDL, cholesterol, history of heart attack and stroke (Table 2). In the next step, all variables except employment status were included in the multivariate logistic regression analysis, and based on the results of multivariate analysis, the probability of diabetes in a person with TG > 150 was 1.79 times higher than in a person with triglyceride less than 150 (OR = 1.79, CI95%: 2–1.59). The probability of developing diabetes in a person with LDL ≥ 100 was 1.45 times higher than in a person with LDL less than 100 (OR = 1.45, CI95%: 1.4–1.51). The probability of diabetes in people with high blood pressure was 2.1 times higher than in healthy people OR = 2.1, CI95%: 1.84–2.4). A person with CVD had a 1.52 times higher chance of developing diabetes than a healthy person (OR = 1.52, CI95%: 1.28–1.82). Those with a history of stroke were 1.9 times more likely to acquire diabetes than those without a history of stroke (OR = 1.91, 95% CI: 1.24–2.94). The probability of diabetes in people with unfavorable waist-to-hip circumference was 1.93 times higher than in the people with suitable waist-to-hip circumference (OR = 1.93, 95% CI: 1.69–2.21). The probability of diabetes in women was 1.4 times higher than in men (OR = 1.4, 95% CI: 1.24–1.58). With increasing age, the probability of diabetes increases (Table 3).

Among the modifiable risk factors, high blood pressure (PAF: 52.38%, 95% CI: 45.65–58.33), waist-to-hip ratio (PAF: 48.19%, 95% CI: 40.83–54.75), history of stroke (PAF: 47.64%, 95% CI: 19.35–65.99), hypercholesterolemia (PAF: 44.13%, 95% CI: 37.11–50), history of CVD (PAF: 34.21%, 95% CI: 21.88–45.05), and LDL ≥ 130 (PAF: 31.03%, 95% CI: 28.57–33.77) had the highest PAF, respectively (Figure 2).

4 | DISCUSSION

4.1 | Principal findings

This study's results showed that the diabetes prevalence was 17.9% in the 30–73-year-old population of Yazd, 20.5% in men and 15.4% in women. Female sex, older age, high blood pressure, unfavorable waist-to-hip ratio, histoty of CVD, heart attack, stroke, LDL ≥ 100, and TG > 150 were related to diabetes.

4.2 | Interpretation

The results showed that there is a significant association between increasing age, and diabetes, which is in line with the results of a cohort study in which the prevalence of the disease increased from 9.8% to 14.3% in the study population with increasing age[19] and another study in which the chance of infection in people over 45 years old is 2.41 times higher.[20] Among the factors contributing to this rise, it is important to note that aging decreases physical activity as a result of body weight gain, and that this increase in weight and fat storage around the belly reduces the body's insulin activity and may result in insulin resistance.[19] The results showed that the chance of diabetes in women is 40% higher than in men, which is consistent with the results of the study of Mirzaei et al.[21] in the healthy heart of Yazd[21–23] and Jung et al.[24] Moreover, no assosiation was observed between sex, and diabetes,[25,26] sex differences can be related to cultural differences and multiple ways of healthy life between men, and women.[27]

Our study showed a significant assosiation between diabetes, and an unfavorable waist-to-hip ratio, but no significant association was observed with BMI. A cross-sectional study (2017) in China followed an association between diabetes, and an unfavorable waist-to-hip ratio.[28] Also, a cohort study showed a significant assosiation between diabetes, and unfavorable waist circumference.[29] In some studies, no significant association was observed between BMI, and waist-to-hip circumference with diabetes.[25,30] A strong correlation between triglycerides, LDL, and diabetes was found in our study. But in a cohort study carried out in Yazd during the first stage of a healthy heart, it was discovered that there is a significant link between higher triglyceride levels and diabetes.[19] However, a cross-sectional study conducted in Saudi Arabia showed no significant assosiation between diabetes, and high triglyceride, high cholesterol, and low HDL levels.[26] Type 2 diabetes, in most cases, causes lipid metabolism disorders,[30] and this increase in the level of fatty acids is a significant factor in insulin resistance.[31]

We found an assosiation between high blood pressure and diabetes. This finding was similar to the results of a 2015 cross-sectional study in Tanzania and Uganda,[32] a study in India 23, and a meta-analysis study.[33] Blood pressure is an indicator of endothelial dysfunction, which can be a risk factor for insulin resistance.[34] On the other hand, the risk of developing diabetes is two times higher in people with high blood pressure.[35]

Our study observed a significant assosiation between diabetes, CVD, and stroke. The risk of diabetes in CVD was 1.52 times, and stroke was 1.94 times compared to healthy people. This result was consistent with the results of other studies.[36,37] Thus, a meta-analysis study showed that CVD are the leading cause of death in people with diabetes.[38] The risk of CVD in diabetic people is 2–4 times that of nondiabetic people.[39]

TABLE 1 The frequency of basic characteristics in the population aged 30–73 studied in Yazd Shahedieh cohort.

Variable	Classification	Total (*n* = 9747)	Diabetes condition Diabetes (*n* = 1747)	Nondiabetes (*n* = 8000)	*p* value
Age (years), mean (*SD*)	NA	48.46 (9.579)	54.93 (8.93)	47.07 (9.226)	<0.001[a]
Waist-to-hip ratio, mean (*SD*)	NA	0.93 (0.07)	0.92 (0.06)	0.97 (0.06)	<0.001[a]
Sex, frequency (percent)	Male	4885 (50.1)	752 (43)	4133 (51.7)	<0.001[b]
	Female	4862 (49.9)	995 (57)	3867 (48.3)	
Level of education, frequency (percent)	Illiterate	1614 (16.6)	552 (31.6)	1062 (13.3)	<0.001[b]
	Primary	3063 (31.3)	646 (37)	2041 (30.0)	
	Intermediate	1622 (16.6)	181 (10.4)	1441 (18.0)	
	Diploma	1947 (20.1)	1735 (21.7)	212 (12.1)	
	Associate	379 (3.9)	328 (4.1)	51 (2.9)	
	Bachelor	938 (9.6)	856 (10.7)	82 (4.7)	
	Master's and higher	198 (2.1)	175 (2.2)	23 (1.3)	
BMI, frequency (percent)	<25	2303 (23.8)	265 (15.2)	2038 (25.7)	<0.001[b]
	25–29.9	4104 (42.4)	748 (42.9)	3356 (42.2)	
	≥30	3279 (33.9)	729 (41.8)	2550 (32.1)	
Marital status, frequency (percent)	Not married	37 (0.4)	1 (0.1)	36 (0.4)	<0.001[b]
	Married	9335 (95.8)	1608 (92)	7727 (96.6)	
	Widow	334 (3.4)	126 (7.2)	208 (2.6)	
	Divorced	43 (0.4)	12 (0.7)	31 (0.4)	
Smoking, frequency (percent) frequency (percent)	Yes	2209 (22.6)	363 (20.8)	1846 (23.1)	0.041[b]
	No	7530 (77.4)	1380 (79.2)	6150 (76.9)	
Employed, frequency (percent)	Yes	4313 (44.2)	478 (27.4)	3835 (47.9)	0.865[b]
	No	5375 (55.1)	1262 (23.5)	4113 (76.5)	
High blood pressure, frequency (percent)	Yes	2071 (21.2)	824 (47.2)	1247 (15.6)	<0.001[b]
	No	7676 (78.8)	923 (52.8)	6753 (84.4)	
history of CVD, frequency (percent)	Yes	783 (8)	326 (18.7)	457 (5.7)	<0.001[b]
	No	8964 (92)	1421 (81.3)	7543 (94.3)	
History of myocardial infarction, frequency (percent)	Yes	213 (2.2)	99 (5.7)	114 (1.4)	<0.001[b]
	No	9534 (97.8)	1648 (94.3)	7886 (98.6)	
History of stroke, frequency (percent)	Yes	110 (1.1)	59 (3.4)	51 (0.6)	<0.001[b]
	No	9637 (98.9)	1688 (96.6)	7949 (99.4)	
TG, frequency (percent)	≥200	4451 (46.5)	1045 (60.3)	3406 (43.4)	<0.001[b]
	<200	5123 (53.5)	687 (39.7)	4436 (56.6)	
LDL, frequency (percent)	≥130	5040 (52.8)	693 (40.2)	4347 (55.6)	<0.001[b]
	<130	4505 (47.2)	1029 (59.8)	3476 (44.4)	
Chol, frequency (percent)	≥240	3531 (36.9)	573 (33.1)	2958 (37.7)	<0.001[b]
	<240	6043 (63.1)	1159 (66.9)	4884 (62.3)	
HDL, frequency (percent)	≤35	559 (5.8)	117 (6.8)	442 (5.6)	0.073[b]
	>35	9015 (94.2)	1615 (93.2)	7400 (94.4)	

Abbreviations: BMI, body mass index; Chol, cholesterol; CVD, cardiovascular diseases; HDL, high-density lipoprotein; LDL, low-density lipoproteins; MI, myocardial infarction; NA, not applicable; *SD*, standard deviation; TG, triglyceride.

[a]Independent *t*-test.

[b]Chi-squared test, significance level <0.05.

TABLE 2 Diabetes risk factors in the univariate logistic regression model.

Variable	Classification	B Coefficient	Curd OR (95% CI)	*p* value[a]
Age (years), mean (*SD*)	NA	0.856	2.35 (1.22–2.5)	<0.001
Waist-to-hip ratio, mean (*SD*)	NA	1.24	3.48 (3.07–3.92)	<0.001
Sex, male/female	NA	0.34	1.41 (1.27–1.57)	<0.001
Level of education	Illiterate	NA	Ref	NA
	Primary	−0.65	0.51 (0.45–0.59)	<0.001
	Intermediate	−1.42	0.24 (0.2–0.29)	<0.001
	Diploma	−1.48	0.23 (0.19–0.28)	<0.001
	Associate degree	−1.2	0.22 (0.21–0.4)	<0.001
	Bachelor	−1.69	0.18 (0.14–0.23)	<0.001
	Master's and higher	−1.43	0.23 (0.18–0.38)	<0.001
BMI	<25	NA	Ref	NA
	25–29.9	0.539	1.71 (1.47–1.99)	<0.001
	≥30	0.788	2.19 (1.88–2.56)	<0.001
Marital status	Not married	NA	Ref	NA
	Married	0.172	1.18 (0.53–2.62)	0.054
	Widow	1.02	2.79 (1.23–6.36)	0.003
	Divorced	0.519	1.68 (0.61–4.6)	0.016
Smoking yes/no	NA	0.131	1.14 (1–1.29)	0.041
Employed yes/no	NA	−0.867	0.42 (0.37–0.47)	0.865
High blood pressure yes/no	NA	1.57	4.83 (4.32–5.4)	<0.001
history of CVD yes/no	NA	1.33	3.78 (3.24–4.41)	<0.001
History of myocardial infarction yes/no	NA	1.42	4.15 (3.15–5.46)	<0.001
History of stroke yes/no	NA	1.69	5.44 (3.73–7.95)	<0.001
TG	≥200	0.684	1.98 (1.78–2.2)	<0.001
	<200	NA	Ref	NA
LDL	≥130	0.619	1.85 (1.67–2)	<0.001
	<130	NA	Ref	NA
Chol	≥240	0.203	1.22 (1–1.36)	<0.001
	<240	NA	Ref	NA
HDL	≤35	0.193	1.21 (0.98–1.49)	0.073
	>35	NA	Ref	NA

Abbreviations: BMI, body mass index; CI, confidence interval; CVD, cardiovascular diseases; HDL, high-density lipoprotein; LDL, low-density lipoproteins; MI, myocardial infarction; NA, not applicable; OR, odds ratio; Ref, reference group; TG, triglyceride.

[a]Univariable logistic regression, significance level <0.05.

Diabetes is one of the critical risk factors for CVD.[40] Diabetes increases complications, and mortality of coronary heart disease.[41,42] The risk of CVD increases with the fasting plasma glucose level even before reaching the diagnosis level of diabetes.[43] Diabetes causes irreversible damage to blood vessels, thus leading to the macrovascular (coronary artery disease, stroke) and microvascular (retinopathy, nephropathy, neuropathy) complications.[44] There was no significant assosiation between smoking and diabetes. As in several previous studies,[45–47] however, in a meta-analysis study conducted on 88 cohort studies, the assosiation between smoking, and the incidence of diabetes was confirmed.[48] This study had no significant assosiation between the education level, and diabetes. Like several previous studies,[49,50] in a meta-analysis study, there was a significant association between low educational status, and diabetes.[33]

TABLE 3 Diabetes risk factors in the multivariable logistic regression model.

Variable	Classification	B Coefficient	Adjusted OR (95% CI)	*p* value[a]
Age (years)	NA	0.597	1.81 (1.67–1.96)	<0.001
Waist to hips	NA	0.066	1.93 (1.69–2.21)	<0.001
Sex, male/female	NA	0.34	1.4 (1.2–1.58)	<0.001
High blood pressure yes/no	NA	0.74	2.1 (1.84–2.4)	<0.001
History of CVD yes/no	NA	0.424	1.52 (1.28–1.82)	<0.001
History of stroke yes/no	NA	0.649	1.91 (1.24–2.94)	0.003
Hypercholesterolemia	≥200	0.587	1.79 (1.59–2)	<0.001
	<200	NA	Ref	NA
Low-density lipoprotein (LDL)	≥130	0.778	1.45 (1.4–1.51)	<0.001
	<130	NA	Ref	NA

Abbreviations: CI, confidence interval; CVD, cardiovascular diseases; LDL, low-density lipoproteins; NA, not applicable; OR, odds ratio; Ref, reference group; TG, triglyceride.

[a]Backward method in the multivariable logistic regression, significance level <0.05. Based on the results of the goodness of fit test, the adequacy of multivariable logistic regression model is confirmed based on Deviance criterion ($p = 0.621$).

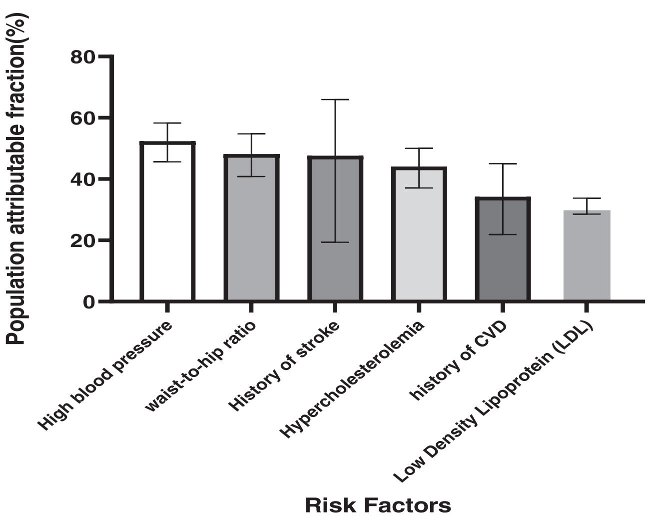


FIGURE 2 Population attributable fraction and 95% confidence intervals of diabetes due to modifiable risk factors.

4.3 | Advantages and limitations

One of the advantages of our study is that it was a population-based study with large sample size. Good and standardized tools and appropriate sampling methods were used. Therefore, it is expected that there is the least torsion in it. Furthermore, a large number of variables were examined. Some limitations of the study: (1) Regarding the study's cross-sectional nature, the cause-and-effect assosiation cannot be shown. (2) These variables were omitted in terms of the lack of information on socioeconomic factors. But, this sample was not representative of all Iranian ethnicities, and the majority of samples were from Fars.

5 | CONCLUSION

In summary, age, female sex, unfavorable waist-to-hip ratio, high blood pressure, History of CVD, stroke, Hypercholesterolemia, and LDL ≥ 130, are the most important risk factors for diabetes. By screening people over 30 years, identifying prediabetic and diabetic people in the early stages, controlling the blood sugar of the patients with proper follow-up, and treatment, and providing nutrition and healthy lifestyle training, its complications can be prevented. Moreover, by giving a regular educational program to people in the community, especially the teenagers, and young people, regarding healthy lifestyle and the risk factors of diabetes, and the effect of each of these factors on the occurrence of disease, we can hope to reduce the prevalence of diabetes in the society in the future.

AUTHOR CONTRIBUTIONS

Ali Dehghani: conceptualization; methodology; project administration; supervision; validation; writing—review & editing. **Hamid Korozhdehi**: conceptualization; data curation; investigation; methodology; software; writing—original draft. **Saeid Hossein Khalilzadeh**: data curation; formal analysis; resources; software; validation. **Hossein Fallahzadeh**: formal analysis; project administration; resources; software; validation. **Vahid Rahmanian**: conceptualization; formal analysis; methodology; software; validation; visualization; writing—review & editing.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The authors acknowledge that data supporting the findings of this study are available in the article [and/or] its Supporting Information Material.

Hamid Korozhdehi had full access to all of the data in this study and takes complete responsibility for the integrity of the data and the accuracy of the data analysis.

TRANSPARENCY STATEMENT

The lead author Hamid Korozhdehi affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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