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A self-assessment predictive model for type 2 diabetes or impaired fasting glycaemia derived from a population-based survey

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ABSTRACT

Aims: There is no cure for diabetes and its prevention is interesting for both people and health policy makers. The aim of this study was to construct a simple scoring system to predict diabetes and suggest a self assessment predictive model for type 2 diabetes in Iran.
Methods: This study was a part of a comprehensive population based survey performed in Ilam province during 2011–2012, including 2158 cases ≥ 25 years. All demographic and laboratory results were entered into the prepared sheets and were analysed using SPSS 16. By identification of relative risks of diabetes and IFG, a predictive model was constructed and proposed for these abnormalities.
Results: Totally, 2158 people comprising 72% female, 60% from urban regions, mean age of 45.5 ± 14 years were investigated and the average height, weight, FBS and waist of participants were as follows respectively: 164 ± 8.9 cm, 68.4 ± 12.3 kg, 5.7 ± 2.8 mmol/l (102.6 ± 49.9 mg/dl) and 82.3 ± 14.3 cm. The prevalence of IFG, diabetes and hyperglycaemia among all participants were 7.8%, 11.8% and 19.6% respectively. Regression analysis revealed familial history of diabetes, place of life, age, hypertension, daily exercise, marital status, gender, waist size, smoking, and BMI as the most relevant risk factors for diabetes and hyperglycemia.
Conclusion: A self-assessment predictive model was constructed for general population living in the west of Iran. This is the first self-assessment predictive model for diabetes in Iran.

1. Introduction

Diabetes and particularly unknown diabetes are increasing worldwide. Current attempts could not prevent the increasing trend of this metabolic disorder. Diagnostic criteria for diabetes are based on epidemiological and laboratory evidences that identify levels, which predict the risk of future complications. Current diagnostic criteria were revised recently by the

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World Health Organisation (WHO), and include a plasma glucose level over 7.0 mmol/l (fasting) or over 11.1 mmol/l (random). "Impaired fasting glycaemia" (IFG) has been later defined where the fasting plasma glucose level is between 6.1 and 6.9 mmol/l [1]. Both IGT and IFG probably represent states of glucose intolerance, which carry an increased risk of future development of type 2 diabetes and cardiovascular diseases [2].

Latent hyperglycaemia is common in hospital in-patients as well as in general population. Globally, it is estimated that 382 million people suffer from diabetes with a prevalence of 8.3% in 2013. North America and the Caribbean are the regions with the highest prevalence (11%), followed by Middle East and North Africa with a prevalence of 9.2% and Western Pacific regions with a prevalence of 8.6%, close to the global prevalence. The number of people with diabetes is expected to rise to 592 million by 2035. Most people with diabetes live in low- and middle-income countries which will most likely experience the greatest increase in cases with diabetes over the next 22 years [3].

Although diabetes mellitus and impaired glucose tolerance are considered as worldwide health problems, hyperglycaemia alone can also create major health disorders. These disorders involve people either in developed or developing countries.

There is no cure for diabetes. Treatment involves medicines, diet, and exercise to control blood glucose and prevent symptoms and complications. Some modifiable risk factors, particularly those associated with life style, have been identified for diabetes and a self preventive intervention would be helpful to eventually reduce the increasing trend of diabetes in the society. Keeping an ideal body weight and an active lifestyle as well as some other modifiable factors may prevent type 2 diabetes but there is no way to prevent type 1 diabetes.

A simple, reproducible, inexpensive, noninvasive, and reliable scoring system that rapidly identifies patients at the highest risk of diabetes has been sought for years [4–7]. Simple and easily calculated scoring systems based on the least risk factors associated with patients' life style are highly needed for chronic diseases such as diabetes. The diabetes risk score is a simple method to identify individuals at the higher risk of type 2 diabetes. Most general scoring systems have combined demographic, anthropometric and laboratory characteristics of patients to predict future risk of diabetes or mortality associated with investigated variables [4–5,7]. However, general populations, especially in a healthy condition, hardly accept invasive methods for self-assessment and hence, the easier a screening model to assess, the higher the chance of its application by the general population.

We hypothesized that a population-based scoring system could be devised to identify individuals at the higher risk of type 2 diabetes, using the results of demographic, anthropometric and laboratory reports. We present the results of investigation of this hypothesis, which has led to developing of a simple prototype scoring system for type 2 diabetes.

The current population-based study was launched to identify the risk factors related to hyperglycaemia and diabetes in Ilam province in the west of Iran. Based on the results of this survey we aimed to create a self-assessment predictive model, according to which all population, particularly high risk individuals can recognize their current status and their future chance of getting diabetes or hyperglycaemia and therefore, by modification of their life style and their preventable risk factors associated with diabetes reduce, their chance of future diabetes or IFG.

2. Materials and methods

This study was a part of a comprehensive population-based survey performed in Ilam province during 2011–2012 [8]. By a cross-sectional method 2158 cases $\geq$ 25 years old, in Ilam province, were included in the study. Ilam province is located in the west of Iran with a population of 557,599 people according to the Iranian population census in 2012.

An adjustment for design effect and correlations among clusters was applied in this study. Participants were informed about the study objectives and were entered into the study if they acclaimed their acceptance for participation. Each participant was taken 2–3 cc vein blood sample, after 12 h fasting, and FBS was measured in a referral laboratory center. FBS $\geq$ 7 mmol/l (126 mg/dl) was considered as abnormal and FBS between 5.6–6.9 mmol/l (100–125 mg/dl) was considered as pre-diabetes [9].

All demographic and laboratory results were entered into a prepared form and analysed using SPSS 16. Factors that predicted diabetes, IFG and hyperglycaemia were determined using logistic regression analysis and were used to construct models which were then tested using receiver operating characteristic (ROC) curves.

2.1. *Sampling method and data collecting procedure*

The samples were selected by a multi-stage sampling method in which a population quota was firstly allocated to the rural and urban levels in Ilam province, considering the last national census in 2007. At the next step, the list of all rural and urban health centres of Ilam province was taken from Ilam University of Medical Sciences. Totally, 19 health centres including 9 from rural and 10 from urban areas were selected for this study that were about one third of all active health centres in the province. Then for each selected health centre, families' health dossier numbers 1–20 were chosen as household levels and investigators completed the questionnaire forms for all the selected families' members aging $\geq$25 years old. If any selected family was absent for completing the questionnaire or did not agree to participate in the study, the first house after the family dossier number of 20 was substituted.

All the participants who agreed to participate in the study were requested to attend in the nearest health centre for interview and laboratory test and those who could not attend or did not consent, were excluded. The information related to fasting blood sugar (FBS) taking and readiness to this test (12 h fasting time before taking a blood sample) had already been prepared in a sheet and was submitted to each family at the day before the test. The importance of fasting before the test was explained, face to face, by questioners during the distribution of information sheets. If, for any reason, the