

RESEARCH ARTICLE**Predicting Type II Diabetes Mellitus among Iraqi Adults at Al Anbar Province Using a Finnish Diabetes Risk Score****Adel Hameed Midhin***PhD in Nursing Science**Academic Nurse, Higher Health Institute, Al-Anbar Health Department, Ministry of Health***Corresponding author: Adel Hameed Midhin****Abstract**

Background: Diabetes mellitus (DM) is considered as one of the major health problems worldwide. Thus, a simple risk-assessment scoring system for early screening of type 2 diabetes mellitus (T2DM) among Iraqi adults will be beneficial to identify the high-risk adults and thus taking adequate preventive measures in fighting diabetes mellitus.

Aims of the study: The aim of this study was to evaluate the ability of FINDRISC to predict progression to diabetes in an Iraqi population without diabetes.

Methodology: A descriptive quantitative design conducted on adult people. It is implemented in order to achieve the objectives of present study, which started from 15 February, 2022 through 15 April, 2022. The instruments have been constructed through the review of available literature, the questionnaire is composed of two parts: Part I: Sociodemographic information; Part II: Finnish Diabetes Risk Score to Predict Type 2 Diabetes Mellitus.

Results: In total, 100 adult people were included in this study. The result shows that the vast majority of the study sample are within third category of age groups (Mean \pm SD 39.2 \pm 10.7 yrs.) and accounted for (61.0%). The majority of the study sample for study group have slightly elevated risk of developing type II Diabetes Mellitus (T2DM) in ten years and they accounted for (40.0%) of the whole sample. The results illustrate that there is high significant relationship between the age groups and the risk of developing type II Diabetes Mellitus score (C.C.= .000). The table also shows that there is non-significant relationship among gender, marital status, occupation status, residency and the risk of developing type II Diabetes Mellitus score (C.C.= .788, .111, .083, .791) retrospectively. Also, there is significant relationship between level of education and the risk of developing type II Diabetes Mellitus score (C.C.= .314).

Conclusions: There is significant relationship among age groups, level of education and diabetic risk score. There is non-significant association among gender, marital status, occupation status, residency and diabetic risk score.

Recommendations: The research recommends the use of the scale in basic health care, mainly by the nurse as a prevention tool for the development of type 2 diabetes mellitus.

Key Words: Finnish diabetes risk score; Type II diabetes mellitus; Adult people, FINDRISC score in Iraq



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Introduction

Type 2 diabetes mellitus (DM2) is becoming more common around the world. According to recent estimates, the number of adults with type II diabetes mellitus (T2DM) will rise by 69 % and 20 % in developing and developed countries, respectively, between 2010 and 2030. (Shaw J. et al. 2009). The prevalence of diabetes mellitus in the Iraqi population is a subject of debate. In the previous ten years, Iraq has experienced remarkable economic growth. Six of the ten nations with the greatest prevalence of diabetes in persons aged 20–79 years, according to the International Diabetes Federation, were in the Middle East: Kuwait (21.1%), Lebanon (20.2%), Qatar (20.2%), Saudi Arabia (20.0%), Bahrain (19.9%), and the United Arab Emirates (19.2 %). Iraq is thought to have a moderate prevalence and based on surveys from 2006 to 2007, 9.3% of people in the Middle East have diabetes (International Diabetes Federation, 2011).

Diabetes is quite common in Basrah, Iraq, impacting one out of every five adults. The financial resources of health-care systems will be strained as a result of the diabetes epidemic (Mansour A. ,2014). Because DM2 is a major risk factor for death and several nonfatal consequences, a growth in its prevalence around the world has become a serious public health problem. As a result, this circumstance will place a significant strain on patients, their families, and the health-care system (Narayan K. et al.,2000). Several studies have shown that DM2 can be avoided and its problems reduced when an early and suitable intervention is implemented (Knowler W. et al. 2002, Tuomilehto J. et al. ,2001). However, in the vast majority of cases, detection is delayed, and many patients already have symptoms of microvascular and macrovascular problems when they are diagnosed (Harris M. et al. ,1992).

Surprisingly, it has been suggested that the Latin American population is more susceptible to developing macrovascular disorders at glycemia levels lower than the globally defined DM2 cut offs (Lopez J. et al,2014). As a result, it is critical to perform early detection of undiagnosed DM2 patients and to identify persons at risk of acquiring DM2 so that extensive preventative measures can be implemented. Increased fasting plasma glucose (FPG), oral glucose tolerance test (OGTT), and/or glycated hemoglobin (HbA1C)

readings are used to diagnose DM2 (America Diabetes Association 2014, Diego et al. 2015). However, determining biochemical variables is expensive, which limits its utility as a large-scale screening tool. Simple risk-scoring questionnaires, on the other hand, are useful and a more cost-effective DM2 screening method (Schwarz P. et al., 2009). As a result, when a high-risk score is obtained, the International Diabetes Federation recommends a blood test to detect possible diabetes (International Diabetes Association, 2014).

Diabetes mellitus (DM) affects around 8.3% of the world's adult population, with the World Health Organization projecting that the overall number of cases of DM would increase from 371 million in 2012 to 552 million by 2030. This rise in DM cases could be attributable to the disease's high prevalence and low incidence, the increased prevalence of overweight and obesity, a lack of physical exercise, and changes in the population's demographic features. More than 90% of diabetic individuals have type 2 diabetes mellitus (T2DM), and more than half of cases go unreported. The use of DM risk scores to determine an individual's risk of undiagnosed T2DM and dysglycemia is a simple, time-saving, non-invasive, and cost-effective method (Saleem M. et al.,2017).

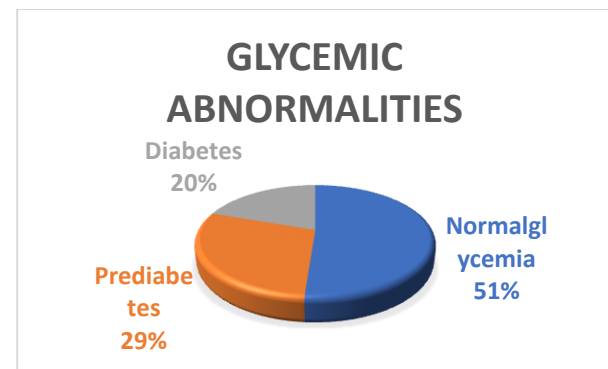


Figure (1): Glycemic abnormalities (Mansour A. et al., 2014)

In my research, I employed the Finnish Diabetes Risk Score (FINDRISC), which is one of the most widely used tools for determining the risk of diabetes (Lindstrom J. et al, 2003). FINDRISC determines if a person has undiagnosed type 2 diabetes mellitus (UT2DM) or dysglycemia, as well as the likelihood of getting type 2 diabetes mellitus (T2DM) in the next ten years. To my knowledge, no research has looked into the validity of the FINDRISC score for UT2DM detection in the Iraqi population. This study was

conducted to assess the effectiveness of the FINDRISC score in screening for UT2DM and any dysglycemia in a representative sample of Iraqis residing in AL Anbar province (The researcher).

Methodology

Research Design

A descriptive quantitative design conducted on adult people. It is being implemented in order to meet the goals of the current study, which runs from February 15 to April 15, 2022.

Technical design Setting

The study is conducted at Al Anbar Health Directorate \ health institutions and attending the Outpatient Department of an AL Ramadi City Primary Health Center.

The Study's Sample

One hundred (100) adults from a non-probability (purposive) sample which attended to the outpatient clinics of a Primary Health Center.

The sample was chosen using inclusion criteria

The following criteria are used to choose the sample:

Those who are voluntary participated.

People who are capable of participating in the research to the end.

All adult people regardless educational level.

Exclusion Criteria

People who have not agreed to participate in the study.

People who have diabetes mellites.

Psychiatric patients.

To avoid false positive prediabetes or diabetes mellitus, individuals who were taking any drug with a potential impact on glucose metabolism (e.g., steroids, B-blockers, and thiazide diuretics) were excluded.

The study did not include pregnant women.

Selection of Sample

A total (100) adult people which they are attended to the outpatient clinics; these have met the study criteria. Random collection is done to

avoid selection bias; this is to control potential confounding; obtainable of (105) adult people have participated in the study group;(5) people from the study group have been dropped out for following reasons, (3) people have refused to complete for unknown reasons and (2) people from the study group have been dropped out too were missed during rest period.

The Instrument of the Study

The instruments have been constructed through the review of available literature, the questionnaire is divided into two sections, the first of which is a preliminary page that invites respondents to engage in the study.

Part one: Socio-demographic Characteristics

This section is concerned with gathering basic socio-demographic information from adults via an interview questionnaire sheet (Age, Gender, Level of education, Marital status, Occupational status and Residency).

Part two: Predicting Type 2 Diabetes Mellitus with the Finnish Diabetes Risk Score

It was composed of 8 Items; related to diabetic mellites risk. The items were multiple score questions, where the total score was 26 which interpreted as follow, (less than 7 score mean low, 7-11score slightly elevated, 12-14 score moderate, 15-20 score high and more than 20 score mean very high). The questionnaire answer list took roughly (15-20) minutes for each respondent.

Ethical consideration

An advanced permission has been obtained from the people for participation and the nature and purpose of the study has been also explained to them.

Primarily the researchers have been introducing themselves to all selected subjects. They are told that the collected data would be hidden.

They are told participation is free and can draw at any time of the study.

Anonymity and confidentiality are consideration.

Names of the subjects were coded for data entry so that their names could not be identified.

These methodologies (Descriptive Statistical Data Analysis Approach and the Inferential Statistics Approach) are analyzed using

the Statistical Package of Social Sciences (SPSS) version (25) program. Analyze the data.

Findings of the Research

The outcomes of the data analysis:

Table (1) Shows the socio-demographic characteristics of the study sample

Socio demographic characteristics Variables	Categories	frequency (N=100)	Percent (%)	Cumulative percent
Gender	Male	65	65.0	65.0
	Female	35	35.0	100.0
Age	Less than 45 years	61	61.0	61.0
	45-54 year	30	30.0	91.0
	55-64 year	8	8.0	99.0
	More than 65 year	1	1.0	100.0
Statistics	Mean \pm SD	39.2 \pm 10.7 (yrs.)		
Level of Education	Illiterate	15	15.0	15.0
	Primary	28	28.0	43.0
	Intermediate	2	2.0	45.0
	Secondary	14	14.0	59.0
	Diploma	31	31.0	90.0
	University and above	10	10.0	100.0
Marital Status	Single	25	25.0	25.0
	Married	73	73.0	98.0
	Widowed	1	1.0	99.0
	Divorce	1	1.0	100.0
Occupational Status	Worker	16	16.0	16.0
	Employee	39	39.0	55.0
	Housewife	27	27.0	82.0
	Student	17	17.0	99.0
	Retired	1	1.0	100.0
Residency	Urban	82	82.0	82.0
	Rural	18	18.0	100.0

#: percentage, yrs.: years, N: number, SD: stander deviation

Table (1) demonstrates that the great majority of the study sample (65.0 %) is male and the remaining is female, as well as that the vast majority of the study sample is within the third category of age groups and accounts for the vast majority of the study sample (61.0 %). In terms of educational attainment, the study group diploma accounted for the majority of them (31.0 %). Regarding to the marital status, the bulk of the

sample are married and they accounted for (73.0 %). Furthermore, the majority of those in the research group are employees who must be accounted for (39.0 %). Finally, the results demonstrate that the majority of the study sample lives in metropolitan areas, as seen in the above table and in relation to residency and they accounted for (82.0 %).

Table 2: FINDRISC Risk Assessment Scoring Method among Iraqi Adults (N = 100).

Item No.	Variable	Classification	Freq.	%	Cumulative Percent
1	The risk of developing Type II Diabetes Mellitus (T2DM) increases over time.	Low	35	35.0	35.0
		Slightly elevated	40	40.0	75.0
		Moderate	17	17.0	92.5
		High	8	8.0	100.0

#: Percentage, Freq.: Frequency, TRS: Total Risk Score (maximum equal (26), TRS < 7 Low(1%), TRS 7-11 Slightly Elevated (4%), TRS 12- 14 Moderate (17%), TRS 15-20 High (33%), TRS ≥20 Very high (50%).

The majority of the study sample for study group had a slightly increased chance of acquiring type II Diabetes Mellitus (T2DM) after ten years, as shown in table (2), accounting for (40.0 %) of the total sample.

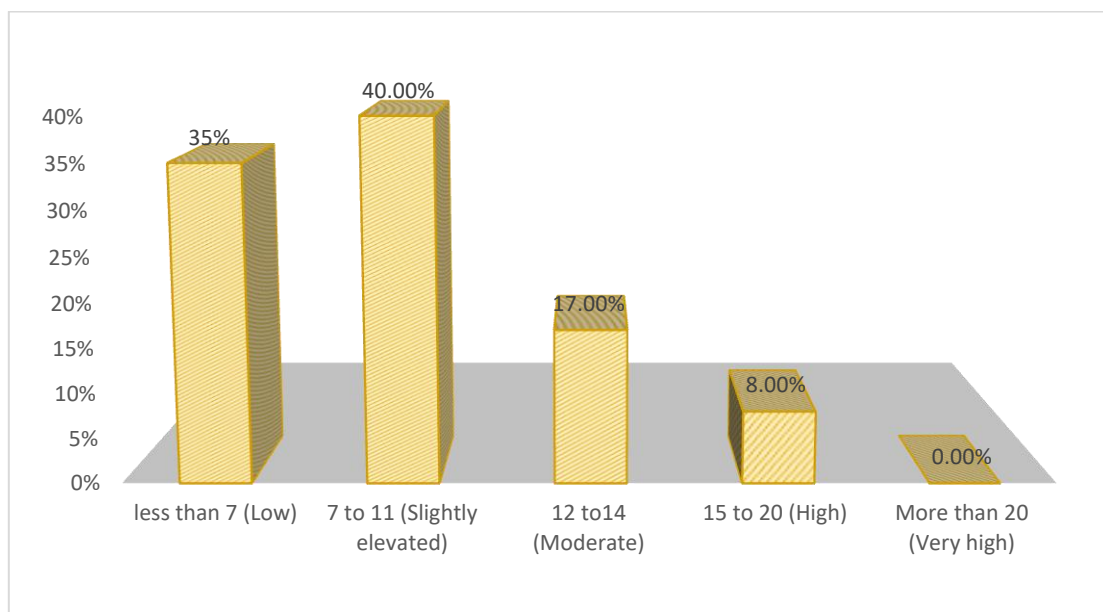


Figure (2): Distribution risk of developing type II Diabetes Mellitus in ten years in the study population (N = 100). (FINDRISC Categories)

Figure 2 illustrates that the majority of the study participants in the study group have a slightly increased chance of getting type II diabetes in ten years, accounting for (40.0%) of the total sample.

Table (3): Association among Sociodemographic Characteristic and Diabetes Risk Score

	Sociodemographic characteristic	Mean	SD.	C.S P. value	Ass.
Risk of developing type II Diabetes Mellitus in ten years Score	Age	1.4900	.68895	CC=.000 P= .000	H.S.
	Gender	1.3500	.47937	CC=.788 P= .402	N.S.
	Marital status	1.7800	.50412	CC=.111 P= .582	N.S.
	Level of education	3.4800	1.72023	CC= .314 P= .009	S.
	Occupation status	2.4800	.98964	CC= .083 P= .658	N.S.
	Residency	1.9800	.92091	CC= .791 P= .920	N.S.

C.S; Contingency Significant, C.C; Contingency Coefficient, H.S; High Significant, N.S; Nonsignificant, S.; Significant, Ass.; Assessment, SD.; Standard Deviation

The association between various sociodemographic factors and diabetes risk score is shown in this table. The findings show that there is a strong association between age groups and the likelihood of having type II Diabetes Mellitus (C.C.=.000). Gender, marital status, occupation status, residency, and the risk of developing type II Diabetes Mellitus score (C.C.=.788,.111,.083,.791) have no statistically significant association, according to the table. In addition, there is a substantial association between educational attainment and the chance of having type II Diabetes Mellitus (C.C.=.314).

Discussion of the Research Findings

With the help of the existing literature and related investigations, this part gives a systematically arranged interpretation and rationally deduced explanation of the results.

Part I: The Socio-Demographic Characteristics Variable in Relation to the Researched Sample: (Table1)

As stated in table one, 65.0 % of the study sample is male, with the residual females. This could be attributable to males attending more events where the sample was gathered (the researcher). This result is accompanied by Akter N. (2020). They claimed that the study population consisted of 205 subjects, with (57.1 %) of males and (42.9 %) of females correspondingly.

In terms of age groupings, the study reveals in table (1) that the dominating age group

of the study sample is (< 45) years old, accounting for (61.0 %), with a mean age of (39.2) years and a standard deviation of (10.7). This is supported by Akter N. (2020), who found that the distribution of their study sample (Prediction of the risk of getting diabetes mellitus among Bangladeshi adults by utilizing risk assessment score), which included 205 individuals, was (57.1 %) men and (42.9 %) women. The male and female (mean \pm SD) ages were 39.82 ± 1.16 and 34.73 ± 8.68 years, respectively. This finding is also consistent with Duncan GE (2006), who claims that diabetes is becoming more prevalent among teenagers and young people. According to Mainous G. et al., (2007), 2.1 % of this young adult group was classified as high risk for diabetes at baseline, but (3.9 %) got diabetes within 10 years.

In terms of education, the bulk of the study sample is diploma holders, accounting for (31.0 %) of the total sample, which could be attributable to the study population's diversity. According to Misra R. et al., (2016), roughly half of the participants (43.3 %) had a high school diploma or less. When it comes to marital status, the majority of the study participants are married, accounting for (73.0%) of the total sample. This result is consistent with Yanfen et al., (2020), who claim that the majority of people are married.

In terms of occupation, the bulk of the study participants are employees, accounting for (39.0 %) of the total sample. According to Aynalem B.Sh. and Zeleke J. A. (2018), the

majority of the study sample is made up of government employees and housewives, accounting for (22.6 %) and (33.3 %), respectively. This finding is also consistent with Jang et al. (2016), who found that non-manual workers had a greater prevalence of diabetes than manual workers.

In terms of residence, the bulk of the study participants live in cities, accounting for (82.0 %) of the total sample. This finding is consistent with Aung et al. (2018), who reported that the prevalence of diabetes mellitus (DM) was 12.1% in urban regions and 7.1 % in rural areas, with no socioeconomic or behavioral risk factors explaining the difference. In urban areas, the percentage of individuals who tested their blood glucose level was higher than in rural areas. This conclusion could be related to higher health education in cities than in rural regions, resulting in the early detection of diabetes mellitus. This finding is also consistent with Aynalem B.Sh. and Zeleke J. A. (2018), who found that the prevalence of diabetes in urban people is typically higher than in rural dwellers. This finding could be related to the fact that urbanization has an impact on people's lifestyles in general.

Part 2: Using the Finnish Diabetes Risk Score to Predict Type 2 Diabetes Mellitus in Ten Years (Table 2).

This discussion is mostly based on the study data, frequency of each variable, which shows that the majority of the study sample for study group has a slightly increased risk of acquiring type II diabetes in ten years, accounting for (40.0 %) of the total sample. This finding is consistent with D'Souza et al., (2013), who found that the majority of the research participants had a slightly raised diabetes risk score (DRS), accounting for 28% of the total study population, while (17.2 %) had a moderate DRS and 9.7% had a very high diabetic risk score (DRS). If no main preventative actions are implemented to reduce T2DM, it is predicted that 26.9% of Omani adults will develop it in the next ten years. This is also supported by Akter N. (2020), who found that 33.65% of Bangladeshi adults had a slightly higher diabetes risk score (DRS). According to this study, 17.55 % of Bangladeshi people have a moderate to high risk of developing Type 2 diabetes mellitus (T2DM) in the next ten years.

Part III: Association between Sociodemographic Characteristic and Diabetes Risk Score (Table 3)

In terms of age groupings, the findings demonstrate that there is a strong correlation between age and diabetes risk score. These findings support those of Solanki et al. (2015), who found a significant link between diabetic mellitus (DM) prevalence and age. These findings also support those of Azimi N. et al. (2008), who discovered that the prevalence of diabetic mellitus (DM) rises with age. This is supported by the findings of Gholamreza V. Et al (2010), who found a positive and substantial relationship between fasting blood glucose (FBS) and age. Additionally, sociodemographic factors influenced diabetes mellitus.

In terms of educational attainment, the findings reveal that there is a substantial link between educational attainment and diabetic risk score. This finding is consistent with that of Aung et al. (2018), who discovered that the most educational groups had the lowest prevalence of diabetic mellitus (DM) ($P = 0.001$). Also, these findings support those of Krishnan S. et al. (2010), who found that a lack of education was linked to an increased risk of type 2 diabetes (T2DM).

The results demonstrate that there is no significant link between gender, marital status, and diabetic risk score when it comes to gender and marital status. These findings are consistent with those of Rahmanian K. et al. (2013), who found that the prevalence of diabetes mellitus was 11.6 % in males and 12.1 % in women, with no significant difference between them. Diabetes mellitus was not associated with marital status ($P=0.37$).

The results demonstrate that there is no significant link between occupation and diabetic risk score when it comes to occupation status. This contradicts Sofia C. et al. (2020), who reported that the link between work and type 2 diabetes was accompanied by significant variations in the prevalence of lifestyle risk variables. In addition, compared to university lecturers and physiotherapists, professional drivers, manufacturing employees, and cleaners had a threefold greater risk of type 2 diabetes.

In terms of residential area, the findings demonstrate that there is no statistically significant link between residential area and

diabetic risk score. This contradicts the findings of Cheema A. et al. (2014), who discovered that living in a city is related with a considerably higher diabetes prevalence ($P = 0.001$).

Conclusions

The researcher comes to the following conclusion based on the findings of this study:

- Males make up the majority of the study samples.
- The majority of the research samples are employees, according to the study.
- The majority of the study participants are married.
- Diplomas make up the great bulk of the study sample.
- The vast majority of the study participants have a modestly increased chance of getting type 2 diabetes in the next ten years, accounting for more than half of the participants (40.0 %).
- There is significant relationship among age groups, level of education and diabetic risk score.
- There is non-significant association among gender, marital status, occupation status, residency and diabetic risk score.

Recommendation

Based on the study conclusion, the study can recommend that:

- Increase health awareness among population by mass media to explain the important risk factors for diabetes mellitus.
- Using the FINDRISC scale in basic health care is a practical, helpful, and efficient instrument that, when utilized by health professionals, particularly nurses, can help identify people who are at risk and execute early preventive actions. The scale should be used in basic health care, primarily by nurses, as a type 2 diabetes mellitus preventive tool, according to the study.
- A larger sample size is recommended for a future study on the same topic.

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References

- Akter N., The risk of acquiring diabetes mellitus in Bangladeshi adults can be predicted using a risk assessment score, *BIRDEM Med Journal* 2020; 10(1): PP. (40-47).
- American Diabetes Association, 2014 Diabetes Medical Care Standards. [PMID: 24357209 DOI: 10.2337/dc14-S014] *Diabetes Care* 2014; 37 Suppl 1: S14-S80 [PMID: 24357209 DOI: 10.2337/dc14-S.
- Aung Ph. W., Htet S. A., Bjertness E., Stigum H., Chongsuvivatwong V., and Kjellesdal R. K. M., Urban-rural disparities in the prevalence of diabetes mellitus among 25-74-year-old individuals in Yangon Region, Myanmar: two cross-sectional studies, *BMJ Open* 2018;8, PP (1-9).
- Aynalem B.Sh. and Zeleke J. A., Prevalence of Diabetes Mellitus and Its Risk Factors among Individuals Aged 15 Years and Above in Mizan Aman Town, Southwest Ethiopia, 2016: A Cross Sectional Study, *International Journal of Endocrinology*, 2018, PP. (1-8).
- Azimi-Nezhad M, Ghayour-Mobarhan M, M.R P, Safarian M, Esmaeili H, Parizadeh SMJ, 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;49(7):571-6.
- Cheema A., Adeloye D., Sidhu S., Sridhar D. and Chan Y. K., **Urbanization and prevalence of type 2 diabetes in Southern Asia: A systematic analysis,**

- journal of global health, 2014, Vol. 4 No. 1, PP. (1-20).
- D'Souza S. M., Amirtharaj A., Venkatesaperumal R., Isac Ch. and Maroof S., Risk-assessment score for screening diabetes mellitus among Omani adults, College of Nursing, Sultan Qaboos University, SAGE Open Medicine, 2013, PP. (1-8).
 - Diego Gomez-Arbelaez, Laura Alvarado-Jurado, Miguel Ayala-Castillo, Leonardo Forero-Naranjo, Paul Anthony Camacho and Patricio Lopez-Jaramillo, Evaluation of the Finnish Diabetes Risk Score to predict type 2 diabetes mellitus in a Colombian population: A longitudinal observational study, *World J Diabetes* 2015 December 10; 6(17): 1337-1344.
 - Duncan GE. Prevalence of diabetes and impaired fasting glucose levels among US adolescents: National Health and Nutrition Examination Survey, 1999-2002. *Arch Pediatr Adolesc Med.* 2006;160(5):523-528.
 - [GholamrezaVeghari](#), [MehdiSedaghat](#), [Hamidreza Joshaghani](#), [Sed AhmadHoseini](#),[FarhadNiknezad](#),[AbdolhamidAngizeh](#),[EbrahimTazik](#),[PonehMoharl oei](#), **Association between socio-demographic factors and diabetes mellitus in the north of Iran: A population-based study**, [International Journal of Diabetes Mellitus](#) , [Volume 2, Issue 3](#), December 2010, PP.(154-157).
 - **Harris MI**, Klein R, Welborn TA, Knudman MW. Onset of NIDDM occurs at least 4-7 yr before clinical diagnosis. *Diabetes Care* 1992; **15**: 815-819 [PMID: 1516497 DOI: 10.2337/diacare.15.7.815].
 - **International Diabetes Federation Guideline Development Group**. Global guideline for type 2 diabetes. *Diabetes Res Clin Pract* 2014; **104**: 1-52 [PMID: 24508150 DOI: 10.1016/j.diabetes.2012.10.001].
 - International Diabetes Federation. *IDF Diabetes Atlas*. 5th ed. Brussels, Belgium: International Diabetes Federation; 2011. [Accessed March 24, 2014]. Available from: <http://www.idf.org/diabetesatlas/5e/the-global-burden>. [[Google Scholar](#)].
 - Jang H. J., Jeon J. Y., Kim I. B., Jin M. H. and Cho J.Y., Prevalence of Diabetes according to Occupation among Workers in the Ulsan Area, *Korean Journal of Family Practice*, 2016;6(4): PP. (293-299).
 - **Knowler WC**, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, Nathan DM. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med* 2002; **346**: 393-403 [PMID: 11832527 DOI: 10.1056/NEJMoa012512].
 - Krishnan S, Cozier YC, Rosenberg L and Palmer JR. Socioeconomic status and incidence of type 2 diabetes: results from the Black Women's Health Study. *Am J Epidemiol.* 2010;171(5):564-70.
 - Lindström J, Tuomilehto J. The diabetes risk score: a practical tool to predict type 2 diabetes risk. *Diabetes Care* 2003; 26:725–731.
 - **López-Jaramillo P**, Gómez-Arbeláez D, López-López J, López-López C, Martínez-Ortega J, Gómez-Rodríguez A, Triana-Cubillos S. The role of leptin/adiponectin ratio in metabolic syndrome and diabetes. *Horm Mol Biol Clin Investig* 2014; **18**: 37-45 [PMID: 25389999 DOI: 10.1515/hmbci-2013-0053].
 - **López-Jaramillo P**, Velandia-Carrillo C, Gómez-Arbeláez D, Aldana-Campos M. Is the present cut-point to define type 2 diabetes appropriate in Latin-Americans? *World J Diabetes* 2014; **5**: 747-755 [PMID: 25512777 DOI: 10.4239/wjd.v5.i6.747].
 - Mainous G. A., Diaz A.V. and Everett J.Ch., Assessing Risk for Development of Diabetes in Young Adults, *ANNALS OFFAMILY MEDICINE* 2007; Vol. (5), No. (5): PP. (425-429).
 - Mansour A.A., Al-Maliky A. A., Kasem.B. Jabar A., and Mosbeh A. Kh., Prevalence of diagnosed and undiagnosed diabetes mellitus in adults aged 19 years

- and older in Basrah, Iraq, Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy 2014:7 PP. (139–144).
- Misra R., Fitch C., Roberts D., and Wright D., Community-Based Diabetes Screening and Risk Assessment in Rural West Virginia, *Journal of Diabetes Research*, 2016, P. (3).
 - **Narayan KM**, Gregg EW, Fagot-Campagna A, Engelgau MM, Vinicor F. Diabetes--a common, growing, serious, costly, and potentially preventable public health problem. *Diabetes Res Clin Pract* 2000; **50** Suppl 2: S77-S84 [PMID: 11024588 DOI: 10.1016/S0168-8227(00)00183-2].
 - Rahmanian K., Shojaei M. and Jahromi S. A., **Relation of type 2 diabetes mellitus with gender, education, and marital status in an Iranian urban population**, *Reports of Biochemistry & Molecular Biology* Vol. 1, No. 2, Apr. 2013, PP. (64-68).
 - Saleem M. Sh., Khan S.M.S. and Jan S.S., **Finnish Diabetic Risk Score: A Tool for Predicting Risk of Undiagnosed Type 2 Diabetes Mellitus**, *Annals of Medical and Health Sciences Research | September-October 2017/ Vol 7 / Issue 5 / PP. (295-298).*
 - **Schwarz PE**, Li J, Lindstrom J, Tuomilehto J. Tools for predicting the risk of type 2 diabetes in daily practice. *Horm Metab Res* 2009; **41**: 86-97 [PMID: 19021089 DOI: 10.1055/s-0028-1087203].
 - **Shaw JE**, Sicree RA, Zimmet PZ. Global estimates of the prevalence of diabetes for 2010 and 2030. *Diabetes Res Clin Pract* 2010; **87**: 4-14 [PMID: 19896746 DOI: 10.1016/j.diabres.2009.10.007].
 - Sofia Carlsson, Tomas Andersson, Mats Talbäck and Maria Feychting, **Incidence and prevalence of type 2 diabetes by occupation: results from all Swedish employees**, *Diabetologia* (2020) 63, PP. (95–103).
 - Solanki Niti , Virk Amrit , Gupta B.P. , Singh Jasdeep ,Prevalence and Risk Factors of Diabetes Mellitus among Adults residing in Field Practice Area of a Teaching Hospital in Punjab, *Healthline Journal* Volume 6 Issue 1, 2015,PP.(57-62).
 - **Tuomilehto J**, Lindström J, Eriksson JG, Valle TT, Hämäläinen H, Ilanne-Parikka P, Keinänen-Kiukkaanniemi S, Laakso M, Louheranta A, Rastas M, Salminen V, Uusitupa M. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *N Engl J Med* 2001; **344**: 1343-1350 [PMID: 11333990 DOI: 10.1056/NEJM200105033441801].
 - Yanfen Hu, Lingxia Li, and Jun Zhang, **Diabetes Distress in Young Adults with Type 2 Diabetes: A Cross-Sectional Survey in China**, 2020, P. (3).