ICQMHeR

ICOMHeR

Translational Health Research.

Interprofessional Education and Collaboration

Current Issues in Health Research and Development

CERTIFICATE

International Conference On Medical and Health Research

This is to certify that

Eva Decroli

as

ORAL PRESENTER

November 13-14th 2018

Mercure Hotel Padang, West Sumatra

KEMENTERIAN RISET TEKNOLOGI DAN PENDIDIKAN TINGGI
UNIVERSITAS ANDALAS
REKTOR

Prof. Dr. Tafdil Husni, SE, MBA
Rector of Andalas University

International Conference on Medical and Health Research
ICQMHeR

Dr. rer. nat. Ikhwan Resmala Sudji, S.Si
Head Committee

DESCRIPTION OF INSULIN RESISTANCE AND BETA CELL PANCREAS DYSFUNCTION IN PREDIABETIC PATIENTS

Abstract.

Introduction: Prediabetes is the forerunner of diabetes mellitus, hence it has to be carefully cared for. Main conditions causing this are insulin resistance and/or beta cell dysfunction. Insulin resistance can be assessed by using several methods, one of which is performed by assessing the value of HOMA-IR. Beta cell function can be determined by assessing HOMA-B. This research aims to obtain description of insulin resistance and beta cell pancreas dysfunction on prediabetic patients**. Methods**: This study is an analytic observational study with cross-sectional approach. The HOMA-IR and HOMA-B were assessed on 20 prediabetic patients. HOMA-IR and HOMA-B values were obtained by examining basal insulin and fasting glucose level. **Results**: We found man to woman ratio 1:1, with mean of age (+/-SD) 35,8 (5,7) years old, BMI 24,9 (4,3) kg/m^2, fasting blood glucose 104,8 (4,3) mg/dL, and blood glucose two hours after oral glucose tolerance test 121,7 (23,1) mg/dl. Mean of HOMA-IR on prediabetic patients was 4,1 (3,2) and mean of HOMA-B was 188,3 (155,1). **Discussion:** The increase of insulin resistance on this study is in accordance with studies that were conducted by Nguyen (2010) and Mohtarin (2016). The increase of HOMA-B in this study is in accordance with other studies by Mohtarin (2016) and Owei (2017), supposedly due to beta cell compensation process against the increase of insulin resistance. **Conclusion:** Increase of HOMA-IR in prediabetics is compensated for by an increase in HOMA-B.

Keywords: Prediabetes, HOMA IR, HOMA B.

1 Introduction

Prediabetic is a part of glycometabolic abnormality caused by insulin resistance and/or beta cell pancreas dysfunction [1]. During progression of prediabetes, in early phase increasing level of blood glucose will be compensated for by increasing level of insulin so that glucose uptake will increase. Then, if there are increasing insulin resistance and/or pancreatic beta cell dysfunction, glucose uptake will decrease resulting in blood glucose level increase. This was described by DeFronzo (2013) using a picture showing mean plasma glucose and mean plasma insulin levels during oral glucose tolerance test (OGTT) and insulin mediated glucose uptake in five groups of people, namely lean-normoglycemic, obesity-

normoglycemic, obesity-impaired glucose tolerance, obesity-diabetes high insulin, and obesity-diabetes low insulin people [2].

Maftin *et al.* (2010) stated that failure of pancreatic beta cells has been occurred at earlier step. Another metabolic research concluded that in impaired glucose tolerance group, there have been maximal insulin resistance and losing of beta cell function in more than 80% [3].

Prediabetes is diagnosed from laboratory parameter when serum blood glucose is higher than normal value, but not high enough for diabetes [4]. Prediabetes consists of impaired glucose tolerance (IGT) and impaired fasting glucose (IFG) level. IGT is defined as a condition when serum glucose level two hours after oral glucose tolerance test is more than 140 mg/dL (7,8 mmol/L) but less than 200 mg/dL (11,1 mmol/L), and IFG is defined as a condition when fasting blood glucose level is 100 mg/dL (5,6 mmol/L) or more but less than 126 mg/dL (7,0 mmol/L) [5],[6].

Centers for Disease Control and Prevention in 2014 presumed that approximately 15-30% prediabetic patient will become diabetes in five years. Nowadays, diabetes mellitus is a global burden and main health problem in the 21st century. The prevalence has increased in last decade. According to International Diabetes Federation Western Pasific Region (WPR) in 2015, of 415 million population of diabetes in the world, 153 million was found in Western Pasific and 10 million in Indonesia [1]. Prediabetic is the forerunner of diabetes mellitus, hence it has to be carefully cared for [5],[6].

As the main process involved in pathophysiology of prediabetes, insulin resistance and beta cell dysfunction need to be assessed. Insulin resistance can be assessed using several methods, one of which is the value of HOMA-IR. Cobb *etal* (2013) concluded that HOMA-IR was an important indicator of development of prediabetes and diabetes mellitus [7]. Beta cell dysfunction is shown by failure of phase 1 insulin secretion in response to blood glucose. Beta cell dysfunction can be determined by assessing the value of HOMA-B. There are many studies about the role of HOMA-B in predicting diabetes [8],[9],[10]. This research aims to obtain the description of insulin resistance and beta cell pancreas dysfunction on prediabetic patients.

2. Methods

This research is an analytic observational study with cross-sectional approach, in which independent and dependent variabel was assessed at the same time. Research was performed on campus of Medical Faculty, Andalas University, Padang, Indonesia for six months. Subjects in this research were selected using random sampling method. Inclusion criteria was prediabetes with family history of having risk of type 2 diabetes mellitus, while exclusion criteria consisted of patient with diabetes mellitus or prediabetes on medication.

Prediabetics that conform with inclusion and exclusion criteria was 20 patients. Data was collected regarding age, sex, body mass index (BMI), fasting blood glucose, and blood glucose level two hours after oral glucose tolerance test. These were followed by assessment of HOMA-IR and HOMA-B. HOMA-IR was equal to fasting insulin (mU/L) x fasting blood

glucose(mmol/L) divided by 22.5, and HOMA-B was equal to 20 x fasting insulin (mU/L) divided by (fasting blood glucose(mmol/L) - 3,5)

3. Results

Means and standard deviations of subjects were obtained as follows: age was 35,75 (5,68) years, ratio of man to woman was 1:1, mean of BMI was 24,85 (4,25) kg/m^2, fasting blood glucose was 104,80 (4,25) mg/dL, and blood glucose level two hours after oral glucose tolerance test was 121,70 (23,10) mg/dL. Based on age group, most of subject (50%) were in 31-40 years range, and most of subjects (50%) were in normal BMI group (Table 1).

Table 1. Characteristics of Prediabetic Patient

Characteristic	n (%)	Mean (SD)
Sex		
■ Man	■ 10 (50%)	
■ Woman	■ 10 (50%)	
Age (year)	20	35,75 (5,68)
■ 21-30	■ 4 (20%)	
■ 31-40	■ 10 (50%)	
■ 41-50	■ 6 (30%)	
Body mass index (kg/m^2)		24,85 (4,37)
■ Normoweight	■ 10 (50%)	
■ Overweight	■ 3 (15%)	
■ Obese I	■ 4 (20%)	
■ Obese II	■ 3 (15%)	
Fasting blood glucose (mg/dL)		104,80 (4,25)
Blood glucose 2 hours OGTT (mg/dL)		121,70(23,10)

Kolmogorov-Smirnov test found that data of levels HOMA-IR and HOMA-B in prediabetic patient were in normal distribution ($p>0.05$). On prediabetics patients, mean of HOMA-IR was 4,12 (3,17) and mean of HOMA-B was 188,31 (155,13). Normal levels for HOMA-IR is less than 2.0, and for HOMA-B is 107 or more.

4. Discussion

Insulin resistance started dysglycemic state in prediabetic and type 2 diabetes mellitus. Cobb *et al.*(2013) stated that insulin resistance is a predictor of risk of metabolic syndrome and cardiovascular disease [11]. Tang *et al.*(2015) stated that insulin resistance is an important factor in prediabetic pathophysiology. So, assessment of insulin resistance by using HOMA-IR is the key for primary prevention of diabetes dan nowadays it has been a part of screening guideline in high risk group [12].

In this study, we found mean of HOMA-IR level at 4,12 (3,17) in prediabetic patient. This is in accordance with Aguirre *et al.* (2012) who concluded that the level of HOMA-IR in prediabetic group consist of IFT group 4,53 (3,82) and IGT group 4,24 (3,21) [13]. The increase of insulin resistance in this study is in accordance with studies conducted by Nguyen (2010) and Mohtarin *et al.* (2016). Mohtarin *et al.* concluded that HOMA-IR level is higher in prediabetic compared to normoglycemic group[14], while Nguyen *et al.* stated that HOMA-IR level is significantly higher in prediabetic compared to normoglycemic groups [15].

Wallace *et al.* (2004) said that beta cell dysfunction is the decrease of its function as seen from abnormal beta cell response to blood glucose concentration [16]. In our study, the mean of HOMA-B level was 188,31 (155,13) in prediabetic patient. This was in accordance with Aguirre *et al.* (2012) who concluded that mean HOMA-B level in prediabetic group was 169 (164) [13]. The increase of HOMA-B in our study is in accordance with works by Mohtarin's (2016) and Owei's (2017). Mohtarin *et al.* (2015) stated that HOMA-B level was significantly higher in 32 prediabetic patients (135) compared to 30 normoglycemic group (125) [14]. Owei *et al.* (2017) found that mean HOMA-B level was significantly higher in prediabetic patients, 132 (57,1) compared to normoglycemic group, 62,4 (62,7) [17].

Koh (2017) said that calculation of HOMA-B shows increase of insulin secretion when random blood glucose level is 180 mg/dL or more. HOMA-B level should be interpreted together with HOMA-IR. This is because increasing insulin sensitivity or decreasing insulin resistance will decrease HOMA-B, which does not reflect the failure of beta cell function [18].

5. Conclusion

Assessment of HOMA-IR and HOMA-B in 20 prediabetic patients showed that they underwent increasing HOMA-IR which was compensated for by increasing HOMA-B.

References

[1] El Din U, Mona M, Dina O.: Uric Acid in the Pathogenesis of Metabolic, Renal, and Cardiovascular Diseases: A review. Egypt: CrossMark. p: 1-12 (2016).

[2] DeFronzo R, Roy E, Muhammad A.: Pathophysiologic Approach to Therapy in Patients With Type 2 Diabetes. Texas: Diabetes Journals. p: 1-12 (2013).

[3] Matfin G, Richard E.: Advances in the Treatment of Prediabetes. USA: Ther Adv Endocrinol Metab. p: 1-10 (2010).

[4] Diabetes Research Wellness Foundation. What is Diabetes (2016)

[5] Pour O, Samuel D.: Prediabetes as A Therapeutic Target. Clinical Chemistry 57:2. p: 215-20 (2011).

[6] Nasrul E, Sofitri.:Hiperurisemia pada Pradiabetes. DiaksesdalamjurnalAndalas ISSN: 2301-7406. (2012).

[7] Cobb J, Walter G, Klaus P, Pamela N, Eric B, James H, et al.:A Novel Fasting Blood Test for Insulin Resitance and Prediabetes. J Diabetes Aci Technol. p: 100-110 (2013).

[8] Sung K, Gerald M, Sun H.: Utility of Homeostasis Model Assessment of β-Cell Function in Predicting Diabetes in 12,924 Healthy Koreans. California: Diabetes Care. p: 200-2 (2010).

[9] Behary P, Ian F, Kevin C.: Indices of Beta-cell Function: Association with Diabetes Control in Patients with Type 2 Diabetes on Stable GLP-1 Agonist Treatment. UK: John Wiley and Son. p: 202 (2014).

[10] International Diabetes Federation. Belgia (2017)

[11] Cobb J, Walter G, Klaus P, Pamela N, Eric B, James H, et al.: A Novel Fasting Blood Test for Insulin Resistance and Prediabetes. Journal of Diabetes Science and Technology. p:1-11 (2013).

[12] Tang Q, Xueqon L, Peipei S, Lingzhong X.: Optimal cut-off values for the homeostasis model assessment of insulin resistance (HOMA-IR) and pre-diabetes screening: Developments in research and prospects for the future China. Tang. p:380-5 (2015).

[13] Aguirre L, B. Aguirre, Garcia L.: Clinical Usefulness of HOMA-IR and Homa Beta Cell Indices for Diabetes Risk Evaluation, Uruguay: Centro de InvestigacionesEndocrinologicas. p: 1 (2012).

[14] Mohtarin S, Matiur R, Subrata K, Forhadul H, Iqbal A.: Study of Phase of Insulin Secretion in Prediabetes and Newly Diagnosed Type 2 Diabetes Mellitus. BSMMU. p: 85-90 (2016).

[15] Nguyen Q, Sathanur R, Ji-Hua X, Wei C, Gerald S.: Fasting Plasma Glucose Levels Within the Normoglycemic Range in Childhood as a Predictor of Prediabetes and Type 2 Diabetes Adulthood. The Bogalusa Heart Study. p:124-8 (2010).

[16] Wallace T, Jonathan C, David R.: Use and Abuse of HOMA Modeling. Diabetes Care. p: 1487-8 (2004).

[17] Owei I, Nkiru U, Casey P, Jim W, Samuel D.: Insulin-sensitive and insulin-resistant obese and non-obese phenotypes: role in prediction of incident pre-diabetes in a longitudinal biracial cohort. BMJ. p:1-6 (2017).

[18] Koh A.: Assessing beta-cell function in patients with type 2 diabetes in clinical practice. Department of General Medicine, Sengkang Health, Singapore (2017).