Original Research Article

Assessment of insulin resistance levels among subjects with normal glucose tolerance, hyperinsulinemia with normal blood glucose tolerance and newly diagnosed T2DM

Naveen Bhartia Porwal*

Associate Professor, Department of Physiology, Hind Institute of Medical Sciences (Sitapur), Uttar Pradesh, India

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Abstract

Background: Hyper-insulinemic euglycemic clamp (HEC) is known to be the "gold standard" for the measurement of insulin sensitivity. The present study compared IR levels among subjects with NGT, hyperinsulinemia with normal blood glucose tolerance (HINS) and newly diagnosed T2DM. **Materials & Methods:**75 subjects were divided into 3 groups of 25 each. Group I was subjects with NGT, group II was hyperinsulinemia with normal blood glucose tolerance (HINS) and group III was newly diagnosed T2DM. Oral glucose tolerance test (OGTT) was administered to all. Assessment of weight, BMI, SBP, DBP, TG, LDL, HDL, TC and HOMA- IR was done.**Results:** Group I had 15 males and 10 females, group II had 13 males and 12 females and group III had 11 males and 14 females. The mean BMI (Kg/m2) was 22.3, 27.3 and 26.4, waist (cm) was 74.2, 86.4 and 90.2, SBP (mm Hg) was 124.0, 120.6 and 126.8, DBP (mm Hg) was 74.2, 80.4 and 76.4, TG (mmol/L) was 1.24, 2.06 and 1.76, LDL (mmol/L) was 2.54, 2.94 and 3.12, HDL (mmol/L) was 1.80, 1.52 and 1.06, TC (mmol/L) was 4.90,5.26 and 4.74, Glu 0 (mmol/L) was 4.11, 4.74 and 5.24, Glu 120 (mmol/L) was 5.44, 6.21 and 13.6 and HOMA- IR was 0.94, 2.56 and 3.02 in group I, II and III respectively. The difference was significant (P< 0.05).**Conclusion:**Insulin resistance existing in subjects with normal glucose tolerance, subjects with hyperinsulinemia with normal blood glucose tolerance (HINS) and in newly diagnosed T2DM.

Key words: Blood glucose tolerance, Diabetes, Insulin resistance.

Introduction

Hyperinsulinemic euglycemic clamp (HEC) is known to be the "gold standard" for the measurement of insulin sensitivity. However, the realization that it is time and money consuming led to the develop-ent of a simplified approach in quantification of insulin sensitivity [1].Various indices of insulin sensitivity/resistance using the data from oral glucose tolerance test (OGTT) were proposed in last 20 years.There are two groups of insulin sensitivity indices: (1) Indices calculated by using fasting plasma concentrations of insulin, glucose and triglycerides,(2) indices calculated by using plasma concentrate-ions of insulin and glucose obtained during 120 min of a standard (75 g glucose) OGTT[2].Several researchers have suggested that IR already exists before blood glucose abnormalities in diabetic patients and that hyperinsulinemia occurs before IGT shows several pathop-hysiological abnormalities[3].Therefore, several scholars have suggested that the T2DM process should be divided into the following three phases:hyperinsulinemia stage,prediabetes stage (IGT, IFG), and diabetes stage. In other words, hyperinsulinemia and IGT are both reserve forces of T2DM. Hyperinsulinemia and IR are harmful even in subjects with NGT. For example, several researchers have indicated that a fasting plasma insulin level (FINS) of 39 Mu /mL or greater was associated with a 31% increased risk of cardio-vascular events in individuals without diabetes[4]. In the transition from normal to impaired and diabetic glucose tolerance, IR is the initiating agent. When the pancreatic beta cells produce enough insulin for compensation, blood glucose is maintained in the normal range; however, when the beta cells do not produce enough insulin to compensate for IR, the blood glucose level is inevitably elevated[5]. The present study compared IR levels among subjects with NGT, hyperinsulinemia with normal blood glucose tolerance (HINS) and newly diagnosed T2DM.

Materials & Methods

The present study was conducted among 75 subjects of both genders in Department of Physiology. All were informed regarding the study and their written consent was obtained. Demographic data such as name, age, gender etc. was recorded. All patients underwent a thorough physical examination. Patients were divided into 3 groups of 25 each. Group I was subjects with NGT, group II was hyperin-sulinemia with normal blood glucose tolerance (HINS) and group III was newly diagnosed T2DM. Oral glucose tolerance test (OGTT) was administered to all. Blood samples were obtained to determine plasma glucose and insulin concentrations before (0 min) and after (120 min) consuming a 75 g glucose drink. Assessment of weight, BMI, SBP, DBP, TG, LDL, HDL, TC and HOMA- IR was done. Results were statistically analyzed. P<0.05 as considered significant.

Results

Table 1:Distribution of patients

Groups	Group I	Group II	Group III
Status	NGT	HINS	T2DM
M:F	15:10	13:12	11:14

Table 1 shows that group I had 15 males and 10 females, group II had 13 males and 12 females and group III had 11 males and 14 females.

*Correspondence

Dr. Naveen Bhartia Porwal

Associate Professor, Department of Physiology, Hind Institute of Medical Sciences (Sitapur), Uttar Pradesh, India.

E-mail: drnaveenporwal9000@gmail.com

Table 2:Baseline parameters

Parameters	Group I	Group II	Group III	P value
BMI (Kg/m^2)	22.3	27.3	26.4	0.12
Waist (cm)	74.2	86.4	90.2	0.90
SBP (mm Hg)	124.0	120.6	126.8	0.92
DBP (mm Hg)	74.2	80.4	76.4	0.17
TG (mmol/L)	1.24	2.06	1.76	0.05
LDL (mmol/L)	2.54	2.94	3.12	0.12
HDL (mmol/L)	1.80	1.52	1.06	0.14
TC (mmol/L)	4.90	5.26	4.74	0.19
Glu 0 (mmol/L)	4.11	4.74	5.24	0.05
Glu 120 (mmol/L)	5.44	6.21	13.6	0.001
HOMA- IR	0.94	2.56	3.02	0.001

Table 2, Fig 1 shows that mean BMI (Kg/m^2) was 22.3, 27.3 and 26.4, waist (cm) was 74.2, 86.4 and 90.2, SBP (mm Hg)was 124.0, 120.6 and 126.8, DBP (mm Hg) was 74.2, 80.4 and 76.4, TG (mmol/L) was 1.24,2.06 and 1.76, LDL (mmol/L) was 2.54, 2.94 and 3.12, HDL (mmol/L) was 1.80, 1.52 and 1.06, TC (mmol/L) was 4.90,5.26 and 4.74, Glu 0 (mmol/L) was 4.11, 4.74 and 5.24, Glu 120 (mmol/L) was 5.44, 6.21 and 13.6 and HOMA- IR was 0.94, 2.56 and 3.02 in group I, II and III respectively. The difference was significant (P< 0.05).

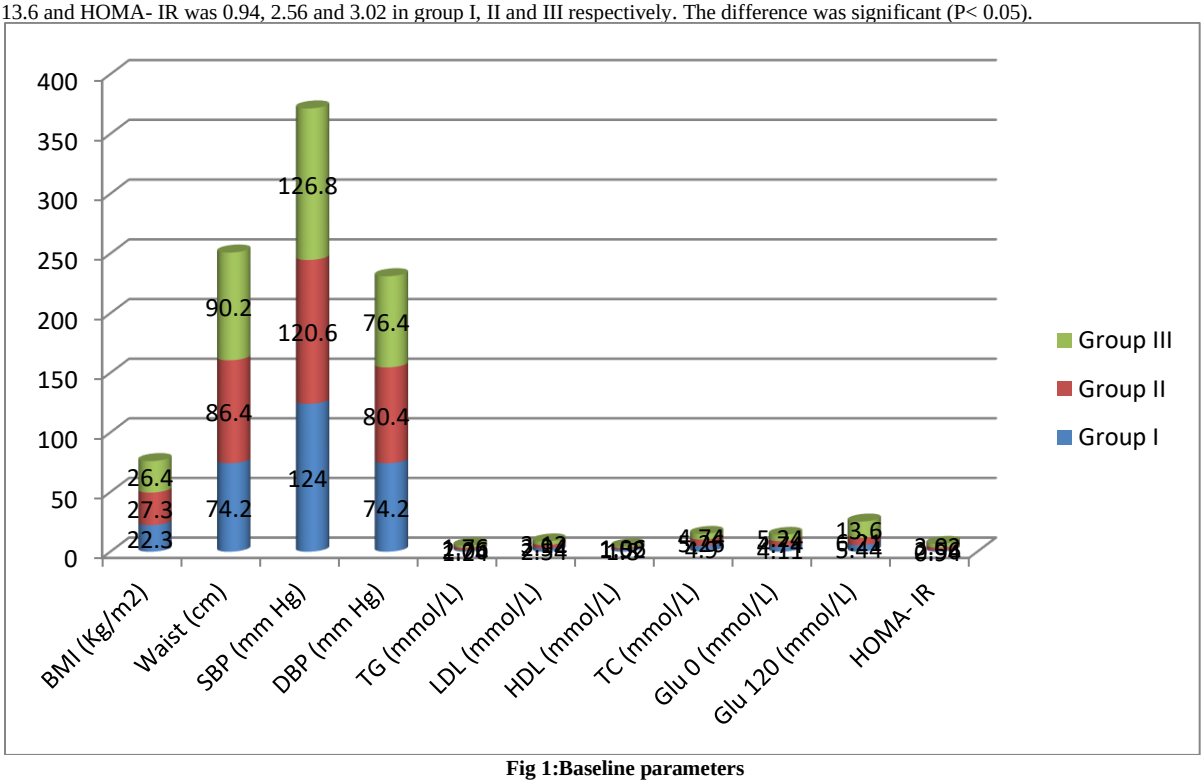

Fig 1:Baseline parameters

Discussion

Insulin resistance is accepted to be a major risk factor in the etiology of type 2 diabetes mellitus, hypertension, dyslipidemia, atherosclerotic vascular disease, and may be a risk factor for coronary heart disease and stroke as well[6]. Several risk factors (e.g. obesity, physical inactivity, body fat distribution, age and hyperinsulinemia) may be considered markers of insulin resistance. Insulin resistance is a predictor for the development of Type 2 diabetes mellitus even in individuals with normal glucose tolerance. Therefore, it is important to recognize insulin resistance in the pre-disease stage when therapeutic intervention is likely to be more successful than in manifest disease[7].Several authors proposed various indices of insulin sensitivity based on the interrelations between the concentration of insulin, glucose and other parameters obtained either in the fasting state or during OGTT and correlated the indices with the data obtained during a HEC[8].The present study compared IR levels among subjects with NGT, hyperinsulinemia withnormal blood glucose tolerance (HINS) and newly diagnosed T2DM.In present study, group I had 15 males and 10 females, group II had 13 males and 12 females and group III had 11 males and 14 females.Yang et al[9] in their study the simple insulin sensitivity indices were calculated, and the correlation between each index and the M value was analyzed. The *M* values of NGT,HINS, IGT, and T2DM groups were 11.88 ± 2.93mg·kg^{-1}·min^{-1}, 6.23±1.73mg·kg^{-1}·min^{-1}, 6.37±2.12mg·kg^{-1}·min^{-1},and 6.19 ±1.89 mg·kg^{-1}·min^{-1}, respectively. *M* values in HINS, IGT, and T2DM groups were lower than those in the NGT group (P = 0.005); however, the differences among the HINS, IGT, and T2DM groups were not statistically significant (P = 0.835). The independent factors influencing the *M* value were waistline and fasting insulin level (FINS). The simple insulin sensitivity indices, especially Matsuda and Gutt index, were significantly associated with the *M* value (P< 0.01).We found that mean BMI (Kg/m^2) was 22.3, 27.3 and 26.4, waist (cm) was 74.2, 86.4 and 90.2, SBP (mm Hg)was 124.0, 120.6 and 126.8, DBP (mm

Hg) was 74.2, 80.4 and 76.4, TG (mmol/L) was 1.24,2.06 and 1.76, LDL (mmol/L) was 2.54, 2.94 and 3.12, HDL (mmol/L) was 1.80, 1.52 and 1.06, TC (mmol/L) was 4.90,5.26 and 4.74, Glu 0 (mmol/L) was 4.11, 4.74 and 5.24, Glu 120 (mmol/L) was 5.44, 6.21 and 13.6 and HOMA- IR was 0.94, 2.56 and 3.Kelly et al [10] suggested that increased serum insulin levels be used as a clinical marker in a primary care setting for early diagnosis and preventative care, which may be beneficial for patients at high risk of diabetes.Another study showed similar results; 515 healthy normoglycemic adults with hyperinsulinemia were followed up for 24 years. Half of the participants developed dysglycemia by the end of the study[11]. Analysis showed that the most significant predictor of progression to dysglycemia was hyperinsulinemia. Hyperinsulinemia is harmful in subjects with normal or abnormal glucose tolerance.The Helsinki policemen study showed that high plasma insulin, fasting or after oral glucose load, was associated with increased risk of major CHD events independently of other conventional cardiovascular risk factors (including blood glucose, cholesterol, triglycerides, blood pressure, indices of obesity, smoking, and physical activity)[12].

Conclusion

Authors found that insulin resistance existing in subjects with normal glucose tolerance, subjects with hyperinsulinemia with normal blood glucose tolerance (HINS) and in newly diagnosed T2DM.

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