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Correlation of HOMA IR with BMI

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Abstract

Background : To assess correlation of HOMA IR with BMI. **Subjects and Methods:** 100 apparently normal subjects were included. Weight and height were measured. BMI was calculated according to the formula BMI = weight in kgs/ (height in metres) 2. HOMA – IR was calculated by the formula, HOMA – IR = fasting Glucose (mg/dl) x fasting plasma Insulin (μU/mL)/405. **Results:** Most of the subjects in the study were between 26 – 30 years of age with mean age being 28.78 years. Most of the subjects taken for the study were females – 62%. 6% had BMI <18.5 Kg/m^2 and 94% had BMI 18.5- 22.9 Kg/m^2. IR (HOMA) found to be 2.65 with minimum value of 0.74 and maximum value of 5.38 and SD of 0.94. BMI was 20.51 Kg/m^2). HOMA – IR had a positive correlation with BMI, p value being <0.001. **Conclusion:** There was positive correlation of HOMA (IR) with BMI.

Keywords: Diabetes, HOMA, BMI.

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Introduction

Prevalence of Diabetes has been on the rise dramatically over the past 2 decades, from an estimated 30 million cases in 1985 to 285 million in 2010. International Diabetes Federation prediction is that 438 million individuals will have diabetes by the year 2030. Although the prevalence of both type 1 and type 2 diabetes is on the rise worldwide, it is type 2 diabetes which is rising much rapidly, presumably because of increasing obesity, reduction in the activity levels as countries become more industrialized and aging of the population.[1]

Insulin resistance and abnormal insulin secretion are the 2 central pillars to the development of type 2 diabetes. Though the primary defect is controversial, most studies support the view that insulin resistance precedes an insulin secretary defect.[2] Another non – communicable disease epidemic that is going on worldwide is that of coronary artery disease. CAD is the single most common cause of death in men and women and the economic burden of CAD on any country is tremendous. The WHO estimates that by the year 2020 the global number of deaths from CAD will have risen from 7.1 million in 2002 to 11.1 million.[3]

It is a well established fact that there is a significant association between insulin resistance and CAD. Gold standard for measurement of insulin resistance is the euglycemic clamp method.[4] Another method that has been widely used to estimate insulin resistance is the homeostasis model assessment – estimated insulin resistance (HOMA – IR). Quantification of insulin resistance by HOMA – IR is more convenient. It is calculated by multiplying fasting plasma insulin (in micro units/ml) by fasting plasma glucose (in mg/dl), then dividing by the constant 405.[5] Many studies have addressed a standardized reference range for HOMA – IR among different populations. But the non – availability of a standardized reference range for HOMA – IR among Indian population has limited its clinical and population application.[6] The present study was conducted to assess correlation of HOMA IR with BMI.

Subjects and Methods

This cross – sectional study was conducted among 100 apparently normal subjects fulfilling the inclusion and exclusion criteria, and willing to be part of the study. Informed consent was obtained from each participant before including in the study.

Inclusion criteria

Subjects with age 18 years and above.

Exclusion criteria

1. Subjects with family history of diabetes mellitus, hypertension or coronary artery disease in first degree relatives.
2. Subjects with a blood pressure more than 130/85 mm HG.
3. Subjects with a fasting blood sugar more than 100 mg/dl.
4. Subjects with a body mass index more than 22.9 kg/m2.
5. Subjects who are on systemic steroids for any reason.
6. Subjects with an abnormal fasting lipid profile (total cholesterol more than 200 mg/dl or triglycerides more than 150 mh/dl or LDL cholesterol more than 100 mg/dl or HDL cholesterol less than 40 mg/dl).
7. Subjects with history of tobacco smoking, tobacco chewing and alcohol consumption.

Subjects fulfilling these criteria were selected for the study.

Parameters such as age, family history of diabetes mellitus, hypertension and coronary artery disease, history of tobacco smoking, tobacco chewing and alcohol consumption, and history of usage of systemic steroids was obtained by detailed history taking. Blood pressure measurement was taken. Weight and height were measured with the subjects wearing light clothing and without shoes on. BMI was calculated according to the formula BMI = weight in kgs/ (height in metres)2. HOMA – IR was calculated by the formula, HOMA – IR = fasting Glucose (mg/dl) x fasting plasma Insulin (μU/mL)/405. Results of the study were analysed using SPSS (Statistical Package for the Social Sciences) version 11 for qualitative data. P value of less than 0.05 will be considered significant.

Results

Table 1: Distribution of patients as per age group

Age group (Years)	Percentage	P value
20-25	5%	<0.05
26-30	80%	
31-35	9%	
36-40	3%	
>40	3%	

Most of the subjects in the study were between 26 – 30 years of age with mean age being 28.78 years [Table 1, Figure 1].

Table 2: Gender wise distribution of patients

Gender	Percentage	P value
Male	38%	<0.05
Female	62%	

Most of the subjects taken for the study were females – 62% [Table 2].

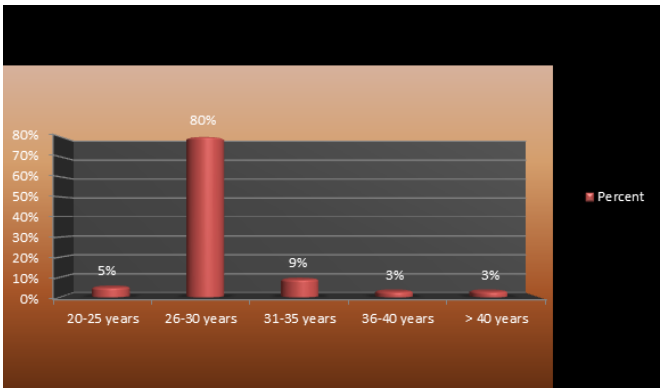

Figure 1: Age Distribution

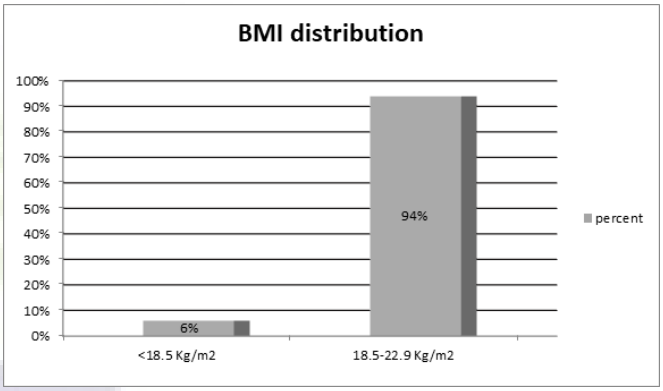

Figure 2: Distribution of BMI

[Figure 2] shows that 6% had BMI <18.5 Kg/m^2 and 94% had BMI 18.5- 22.9 Kg/m^2.

Table 3: 3: Descriptive statistics

Parameters	Number	Min.	Max	Mean	SD
IR(HOMA)	100	.74	5.38	2.65	0.94
BMI (Kg/m$^{2)}$	100	18.0	22.9	20.51	1.37

IR (HOMA) found to be 2.65 with minimum value of 0.74 and maximum value of 5.38 and SD of 0.94. BMI was 20.51 Kg/m^2) [Table 3].

Table 4: Correlation of HOMA (IR) with BMI

BMI	R value	P value
	0.12	0.01

HOMA – IR had a positive correlation with BMI, p value being <0.001.

Discussion

Insulin resistance (IR) and the metabolic abnormalities related to IR have been associated with metabolic syndrome (MS), type 2 diabetes mellitus (T2DM) and cardiovascular disease (CVD) in adults and in the elderly.[7] MS is now increasingly being recognized in children and adolescents.[8] Childhood obesity which is increasing worldwide is well known for its association with IR. IR is typically defined as decreased sensitivity or responsiveness to the metabolic actions of insulin, such as insulin-mediated glucose disposal and inhibition of hepatic glucose production.[9] There are various tools used for quantifying insulin sensitivity and resistance directly (hyperinsulinemic euglycemic glucose clamping and insulin suppression tests) and indirectly [frequently sampled intravenous glucose tolerance test, oral glucose tolerance test, meal tolerance test, and homeostasis model of assessment-IR (HOMA)]. The utility of HOMA-IR in assessment of IR has been validated in children and adolescents. A HOMA-IR value of 2.5 is taken as an indicator of IR in adults, but the corresponding value in children and adolescents has not been established.[10] The present study was conducted to assess correlation of HOMA IR with BMI.

We found that most of the subjects in the study were between 26 – 30 years of age with mean age being 28.78 years. The HOMA method developed by Matthews et al,[11] was used in this study to quantify insulin resistance as it is simple and appropriate to our condition. In this study, the mean HOMA – IR value was found to be 2.65 and 97 (97%) of the subjects demonstrated HOMA – IR values greater than 1. HOMA – IR score greater than 1 implies insulin sensitivity less than 100% and this could imply insulin resistance. Though a HOMA – IR score of 1 is considered ideal, a HOMA – IR value between 1.21 and 1.45 was reported for normal subjects by Matthews et al. Bonora et al,[12] found a mean HOMA – IR score of 2.06 $\pm$ 0.14 among 62 non – diabetic subjects, the mean BMI of that Italian population being 27.8 $\pm$ 0.7 and 16 of them being hypertensives.

We found that most of the subjects taken for the study were females – 62%. 6% had BMI <18.5 Kg/m^2 and 94% had BMI 18.5- 22.9 Kg/m^2. Singh et al,[13] total of 691 apparently healthy adolescents (295 with normal body mass index (BMI), 205 overweight, and 199 obese) were included in this cross-sectional study. MS in adolescents was defined by International Diabetes Federation (IDF) and Adult Treatment Panel III (ATP III) criteria. IR was calculated using the HOMA model. Mean height, waist circumference (WC), waist/hip ratio (WHR), waist/height ratio (WHtR), and blood pressure were significantly higher in boys as compared to girls. The HOMA-IR values increased progressively from normal weight to obese adolescents in both sexes. Mean HOMA-IR values increased progressively according to sexual maturity rating in both sexes. HOMA-IR value of 2.5 had a sensitivity of >70% and specificity of >60% for MS. This cut-off identified larger number of adolescents with MS in different BMI categories (19.7% in normal weight, 51.7% in overweight, and 77.0% in obese subjects) as compared to the use of IDF or ATP III criteria for diagnosing MS. Odds ratio for having IR (HOMA-IR of >2.5) was highest with WHtR (4.9, p <0.0001) and WC (4.8, p <0.0001), compared to WHR (3.3, p <0.0001).

We observed that IR (HOMA) found to be 2.65 with minimum value of 0.74 and maximum value of 5.38 and SD of 0.94. BMI was 20.51 Kg/m^2). We observed that HOMA – IR had a positive correlation with BMI, p value being <0.001. Esteghamati et al,[14] studied 1276 non – diabetic, normotensive Iranian subjects and arrived at a HOMA – IR cut off at 1.8. The area under the curve (AUC) (95%CI) was 0.650 (0.631-0.670) for IDF-defined MetS and 0.683 (0.664-0.703) with the ATPIII definition. The optimal HOMA-IR cut-off for the diagnosis of IDF- and ATPIII-defined MetS in non-diabetic individuals was 1.775 (sensitivity: 57.3%, specificity: 65.3%, with ATPIII; sensitivity: 55.9%, specificity: 64.7%, with IDF). The optimal cut-offs in diabetic individuals were 3.875 (sensitivity: 49.7%, specificity: 69.6%) and 4.325 (sensitivity: 45.4%, specificity: 69.0%) for ATPIII- and IDF-defined MetS, respectively.

Conclusion

There was positive correlation of HOMA (IR) with BMI.

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