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A Study to Compare the Changes on Haematological Parameters in Obese Subjectswith Insulin Resistance and Non-Obese Subjects

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Abstract

Background: Insulin resistance is a decreased biological response to normal levels of circulating insulin. Decrease in insulin response causes increased stimulation of beta cell as a compensatory mechanism resulting in hyperinsulinemia.Insulin resistance is related with genetic susceptibility and obesity. Aim: The present study was planned to study the relationship between insulin resistance and haematological parameters in obese population**Material and Methods:**The subjects selected are 83 in number with age group 30 to 50 years of both the sex and they are grouped into 50 control (non-obese) subjects were free from insulin resistance and 33 cases (obese) subjects having insuin resistance. In all the subjects we have measured height and weight, and calculated body mass index.We have also collected fasting blood samples and measured fasting plasma glucose and fasting plasma insulin. Insulin resistance in the subjects was calculated by homeostasis model assessment index (HOMA-IR) and haematological parameters such as red blood cell counts, haemoglobin concentration, haematocrit value, total leucocyte count, platelet count and fibrinogen level estimated in all the subjects.**Results &Conclusion:**The means are compared using student's 't' test and proportion compared using chi-sqare test. We found increased red blood cell count ($p=0.0001$), haemoglobin concentration ($p=0.0001$), haematocrit value ($p=0.0001$), total leucocyte count ($p=0.0001$) and platelet count ($p=0.0001$), and these values were statistically significant ($p<0.05$). There was no significant change in fibrinogen level in obese subjects with insulin resistance when compared to control (non-obese) group.

Keywords: Body mass index, Insulin Resistance, Homeostasis model assessment (HOMA).

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Introduction

Insulin resistance is a decreased biological response to normal levels of circulating insulin.[1] Insulin resistance is related with genetic susceptibility and obesity. Both obesity and insulin resistance may lead to non-insulin dependent diabetes mellitus.[2] Insulin resistance is a prominent feature of noninsulin- dependent diabetes mellitus (type 2 diabetes mellitus) and is also associated with other conditions such as obesity,[3] polycystic ovarian syndrome.[4]Some researchers also believe that there may be link between insulin resistance and some forms of cancer.[5]A substantial fraction of hypertensive population also have insulin resistance.[6] Patients suffering from acanthosis nigricans and persons with insulin receptor antibodies also develop insulin resistance.[7]Insulin resistance/Hyperinsulinemia is associated with a number of biochemical and haematological changes, for example hyperinsulinemia seen in metabolic syndrome is associated with increase in red blood cell count, haemoglobin content, haematocrit and white blood cell count.[8-11] In obese persons with insulin resistance fibrinogen levels are increased.[12] In some studies platelet count was shown to be increased

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where as in other studies there was no change.[13,14] It is seen that increase in red blood cell count haemoglobin content and haematocrit values are important predictors of acute cardiovascular events like myocardial infarction/unstable angina.[15]Increased white blood cell and platelet counts and increased fibrinogen levels are associated with increased risk of atherosclerosis and cardiovascular diseases.[16,17]

Material and Methods

After the institutional ethics committee approved our study protocol, we have conducted a cross-sectional study on 83 Subjects with age group 30 to 50 years of both the sex and they are grouped into 50 control (non-obese) subjects were free from insulin resistance and 33 cases (obese) subjects having insuin resistance were chosen for the study. Informed consent was taken from all the subjects. In all the subjects body mass index (BMI) was calculated by measuring weight and height of subjects(Quetelet's index) and fasting plasma insulin and fasting plasma glucose levels were estimated and HOMA-IR was calculated by using the formula.

$$\text{HOMA-IR} = \frac{\text{Fasting plasma insulin } (\mu U/ml) \times \text{fasting plasma glucose } (mmol/l)}{22.5}$$

(Glucose concentration in mmol/l=glucose concentration (mg/dl) x0.055)

Inclusion and exclusion criteria:

The case group: Subjects with body mass index ≥30 are categorized as obese and Presence of insulin Resistance as assessed by HOMA-IR were considered as the case group for the present study. Those with a History of hypertension, pulmonary, hepatic, immunological, haematological and malignant diseases were excluded from the present study.

Control group: Subjects with body mass index <30 were considered as the control group for the present study. Those with a History of hypertension, Diabetes Mellitus, Presence of insulin Resistance as assessed by HOMA-IR were excluded from the present study.

In all the subjects (Test group+ Control group) following haematological parameters were assessed.

1. Estimation of haemoglobin, Red Blood Cell count, Haematocrit value, Total Leucocyte countand platelet count - Blood sample was collected from ante cubital vein under aseptic condition in E.D.T.A. vial for above mentioned parameters were estimated by Beckman Coulter's automatic analyzer.
2. Plasma Fibrinogen- Blood sample was collected under aseptic precautions. 9 parts of freshly collected blood was mixed with 1 part of tri-sodium citrate, (3.2%). Sample was centrifuged immediately for 15 minutes at 1500-3000 rpm. Plasma was transferred into a clean test tube and measured by Quantia – Fibrinogen is a turbidimetric immunoassay.

Results

Table 1: Comparison ofHb Concentration in Non Obese and Obese subjects with IR

Parameter	Group	N	Mean	Std. Deviation	Std. Error Mean	P Value
Hb	Non-obese	50	12.1000	.69605	.09844	.0001
Hb	Obese with IR	33	14.0818	.66023	.09844	

Obese subjects with IR were having increased Hb concentration which was statistically significant (p = .0001).

Table 2: Comparison ofR.B.C. count in Non Obese and Obese subjectswith IR

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Parameter	Group	N	Mean	Std. Deviation	Std. Error Mean	
R.B.C.	Non-obese	50	4.2024	.40892	.05783	.0001
R.B.C.	Obese with IR	33	5.1733	.28953	.05040	

Obese subjects with IR were having increased R.B.C. count which was statistically significant (p = .0001).

Table 3: comparison ofP.C.V. in Non-Obese and Obese with IR

Parameter	Group	N	Mean	Std. Deviation	Std. Error Mean	
P.C.V.	Non-obese	50	39.72	1.949	.276	
P.C.V.	Obese with IR	33	41.55	1.878	.327	.0001

Obese subjects with IR were having increased P.C.V. which was statistically significant (p=.0001).

Table 4: Comparison of T.L.C. in Non Obese and Obese with IR

Parameter	Group	N	Mean	Std. Deviation	Std. Error Mean	
T.L.C.	Non-obese	50	6118.00	1022.540	144.609	.0001
T.L.C.	Obese with IR	33	8897.00	849.811	147.933	

Obese subjects with IR were having increased T.L.C. which was statistically significant (p = .0001).

Table 5: Comparison ofPlatelet count in Non Obese and Obese with IR

Parameter	Group	N	Mean	Std. Deviation	Std. Error Mean	
Platelet	Non-obese	50	222080.00	34233.198	4841.305	.0001
Platelet	Obese with IR	33	278212.12	61970.133	10787.615	

Obese subjects with IR were having increased Platelets which was statistically significant (p = .0001).

Table 6: Comparison of Fibrinogen level in Non Obese and Obese with IR

Parameter	Group	N	Mean	Std. Deviation	Std. Error Mean	
Fibrinogen	Non-obese	50	2.6368	.67561	.09555	.1891
Fibrinogen	Obese with IR	33	2.8412	.70482	.12269	

Obese subjects with IR were having increased Fibrinogen levels which were not statistically significant (p = .189).

Discussion

In our study, we are reporting the changes in haematological parameters in obese subjects with insulin resistance (cut off value for HOMA-IR was 2.35)andcontrol(non-obese) subjects were free from insulin resistance.

It has been observed that thered blood cell count (p=0.0001), haemoglobin concentration (p=0.0001), haematocrit value (p=0.0001), total leucocyte count (p=0.0001) and platelet count (p=0.0001) increased, and these values were statistically significant (p<0.05). There was no significant change in fibrinogen level in obese subjects with insulin resistance when compared to control (non-obese) group.[17-21]

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Various cytokines and growth factors play a role in regulation of erythropoiesis.Among these factors erythropoietin is required for differentiation and development of erythrocyte progenitors.[22] Insulin has a synergistic effect together with erythropoietin in stimulating the proliferation of erythroid colony.[23,24] In previous studies it was found that, physiological concentration of insulin, directly stimulates the proliferation of late erythroid progenitor in a culture of murine fetal liver.[19] In other studies, it was found that insulin promotes growth in both human bone marrow and circulating erythroid progenitor cells in vitro.[18-21] The stimulatory effect of human insulin on human bone marrow CFU-E and BFU-E and the relation between insulin and erythropoietin has been proven.[20,21,25] In these reports, it was postulated that insulin receptor itself might play a role in erythrocyte proliferation. Insulin receptor has been detected in various stages of human erythrocyte development.[20] Therefore, it was also assumed that insulin affects all stages of erythropoiesis. Theoretically, widely accepted mechanism for the stimulatory effect on the erythropoiesis by insulin is, tyrosine kinase activation on insulin receptor, which could be essential for mitogenesis in haematopoietic cells.[26] However the relation between insulin and erythropoiesis in vivo has not been well-documented. Indirect evidence derived from data showed that polycythemia was frequently found in diabetic mothers. This could be because of the stimulatory effect of insulin on cord blood erythroid progenitors.[27]

A study conducted by Barbieri et al (2001), demonstrated in vivo, evidence about correlation between insulin resistance/Hyperinsulinemia and erythrocyte counts. They found that IR was positively correlated with red blood cell count, haemoglobin concentration and haematocrit.

Conclusion

In the present study,We have compared haematological parameters of obese subjects with insulin resistance to non - obese subjects. It was observed that Obese subjects with insulin resistance were having higher red blood cell count, haemoglobin concentration, haematocrit value, total leucocyte count and platelet counts when compared to control (non-obese) subjects. There was no significant change in fibrinogen level in obese subjects with insulin resistance when compared to control (non-obese) subjects.

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