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Evaluation of fasting serum insulin in different age groups of the local population

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Abstract: As the economical and financial problems are rising day by day, increasing tensions in the daily lives are resulting in a greater prevalence of *diabetes mellitus* among the population. The objective of our study was to assess the fasting serum insulin levels in different age groups of the population of Rawalpindi/Islamabad, in order to determine their metabolic status. Insulin levels in venous blood were ascertained using electrochemiluminescence, on Roche Elecsys 2010. Data were analyzed by applying correlation and student's 't' test. It was seen that age significantly correlated positively with fasting serum insulin levels ($p < 0.05$), when all the patients were either studied together, or when only the male subjects were considered, while non-significant negative correlation ($p>0.05$) was observed for female subjects. On the basis of age groups, it was seen that although mean age varied significantly ($p< 0.05$) yet fasting serum insulin levels exhibited a non-significant variation ($p> 0.05$), when subjected to student's 't' test, for all groups, combined as well as divided on the basis of their genders. The results also demonstrated that a vast majority of the patients had high fasting serum insulin levels, indicating a poor glycemic control in the population, as well as exhibiting that the prevalence of *diabetes mellitus* in the studied population is not age dependent.

Keywords: Diabetes mellitus, fasting, serum insulin, gender, age groups, Pakistan.
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INTRODUCTION

Serum insulin determinations are mainly performed on patients with symptoms of hypoglycaemia (low blood sugar levels) and are used to ascertain the glucose/insulin quotients. It is also established that insulin resistance, type 2 diabetes, the metabolic syndrome and cardiovascular disease are closely linked[1]. Although the adequacy of pancreatic insulin synthesis is frequently assessed via the determination of C-peptide, it is still generally necessary to determine insulin. It has been reported that therapeutic administration of insulin of non-human origin could lead to the formation of anti-insulin antibodies. In this case, measurement of the concentration of serum insulin shows the quality of free, and hence biologically active-hormone, whereas the determination of C-peptide provides a measure of the patients' total endogenous insulin secretion[2].

Immunoassays for insulin have been widely used to provide supplementary information, first, for the diagnosis of *diabetes mellitus*, and, second, for differential diagnosis of fasting hypoglycaemia to discriminate between insulinoma and factitious hypoglycaemia[3]. Other uses of insulin assays have been suggested by the finding of an increase I risk factors for coronary artery disease among healthy persons, with hyperinulinemia and normal glucose tolerance[4]. Although in case of hypoglycaemia, hyperinsulinism accounts for only 1% adult cases, it accounts for almost 50% cases among neonates[5].

Insulin resistance may contribute to the development of hyperglycaemia which in turn stimulates the beta cells releasing insulin into circulation[6]. Non-insulin dependent diabetic patients have higher morbidity and mortality for various vascular events[7]. The role of diet in affecting insulin sensitivity is well documented[8-11].

The present study was carried out to study the interrelationship of age and fasting serum insulin levels among diabetics to generate data which could help the physicians to diagnose/manage the cases of *diabetes mellitus* in the studied population.

MATERIALS AND METHODS

Collection of blood samples

Fresh blood (5 ml) was drawn between 9 and 11 AM from the fasting subjects in sterile disposable syringes (Terumu). The blood was transferred to clean test tubes and serum was allowed to retract. Once retracted, serum was separated by centrifugation, and kept frozen till assayed.

Estimation of serum insulin

Fasting serum Insulin was quantified using the commercially available kits for Roche Diagnostics Elecsys 2010 system, using electrochemiluminescence technique.

Quality control of assays

Quality control samples representing the lower and upper range of the assay were used for quality control of the results. Results $\pm$ 1SD of the target value were considered acceptable. Only the batches with both the controls being within permissible were accepted.

Statistical analysis

Data were expressed as Mean$\pm$SEM, and comparison with the control group was carried out through calculation of coefficient of correlation and

the 't' test. The data were subjected to analysis, both collectively as well with respect to genders. The same groups were then split into different age groups and the mean age and fasting serum insulin levels were compared using student's 't' test, as described by Steel and Torrie[12].

RESULTS AND DISCUSSION

Age was seen to be significantly positively correlated with fasting serum insulin levels ($p < 0.05$), when all the patients were either studied together (Figure 1), or when only the male subjects were considered (Figure 2), while a non-significant negative correlation ($p>0.05$) was observed in case of female subjects (Figure 3).

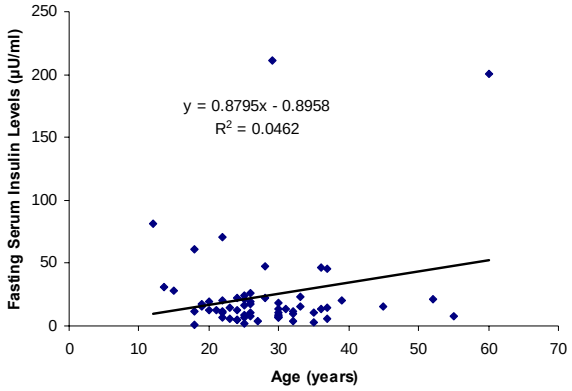

Figure 1: Significant correlation ($p<0.05$) observed between fasting serum insulin levels and age (all patients).

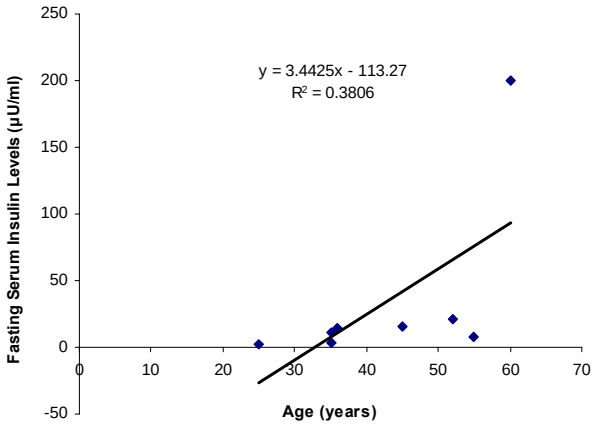

Figure 2: Significant correlation ($p<0.05$) observed between fasting serum insulin levels and age (male patients).

In case of insulin resistance, a condition characterised in type 2 *diabetes mellitus*, insulin is secreted normally but it fails to circumvent serum glucose levels. Although fewer males were part of this study, they represented a higher age group as compared to the females (Table 1). Taken separately, mean levels of fasting serum insulin the male patients was higher than the upper limit, yet it varied insignificantly with respect to the female patients as well as the entire population ($p>0.05$), with means of both the latter categories falling within the normal levels (2.6-24.9 µU/ml). When analyzed from the aspect of different age groups, it was seen that only one male was under the age of 30 years (Table 2), and had insulin levels below the reference range (Table 3). Mean levels among female patients in the age span of 16 to 25 years were within the permissible levels, however, the levels fluctuated from below the reference levels to well above the upper limits. All patients between the ages of 31-35 years had their serum levels within the reference range. Amongst the subjects older than 35, no case was seen in which levels were below the reference range, with cases exhibiting levels above the upper limits.

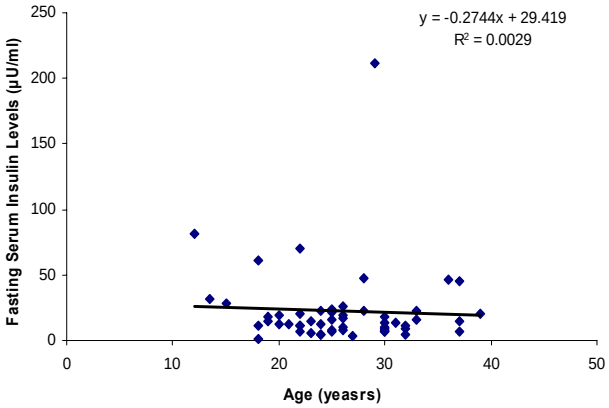

Figure 3: Non-significant correlation ($p>0.05$) observed between fasting serum insulin levels and age (female patients).

Table 1: Fasting Serum Insulin levels in relation to age (gender wise).

Gender	n	Age (years)		Fasting Serum Insulin Levels (µU/ml)	
		Mean±SE	Range	Mean±SE	Range
Male	8	42.88 ±4.27[a]	25-60	34.33 ±23.80[a]	2.00-200.20
Female	54	25.95 ±0.83[b]	12-39	22.30 ±4.21[a]	1.34-211.70
Combined	62	28.14 ±1.15[b]	12-60	23.85 ±4.70[a]	1.34-211.70

Means sharing a common letter do not differ significantly, others differ significantly ($p< 0.05$).

Table 2: Mean age of the subjects in various age groups.

Age group	Combined			Male			Female		
	n	Mean±SE	Range	n	Mean±SE	Range	n	Mean±SE	Range
10-15	3	13.50±0.87[a]	12-15	-	-	-	3	13.50±0.87[a]	12-15
16-20	7	18.86±0.34[b]	18-20	-	-	-	7	18.86±0.34[b]	18-20
21-25	18	23.50±0.33[c]	21-25	1	25.00±0.00[a]	25	17	23.41±0.33[c]	21-25
26-30	16	28.25±0.45[d]	26-30	-	-	-	16	28.25±0.45[d]	26-30
31-35	8	32.88±0.52[e]	31-35	2	35.00±0.00[b]	35	6	32.17±0.31[e]	31-33
36-40	6	37.00±0.45[f]	36-39	1	36.00±0.00[c]	36	5	37.20±0.49[f]	36-39
40+	4	53.00±3.14[g]	45-60	4	53.00±3.14[d]	45-60	-	-	-

Means sharing a common letter do not differ significantly, others differ significantly ($p< 0.05$).

Table 3: Fasting Serum Insulin levels (µU/ml) in different age groups (years).

Age group.	Combined			Male			Female		
	n	Mean±SE	Range	n	Mean±SE	Range	n	Mean±SE	Range
10-15	3	46.80 ±17.28[a]	27.86-81.30	-	-	-	3	46.80 ±17.28[a]	27.86-81.30
16-20	7	19.72 ±7.20[a]	1.34-60.87	-	-	-	7	19.72 ±7.20[a]	1.34-60.87
21-25	18	15.4 0±3.60[a]	2.00-70.39	1	2.00 ±0.00[a]	2.00-2.00	17	16.23 ±3.61[a]	4.51-70.39
26-30	16	27.45±12.58[a]	3.91-211.70	-	-	-	16	27.45 ±12.58[a]	3.91-211.70
31-35	8	11.50 ±2.27[a]	3.04-23.17	2	6.97 ±3.93[b]	3.04-10.90	6	13.00 ±2.60 [a]	4.20-23.17
36-40	6	24.54 ±6.96 [a]	6.28-46.21	1	14.00 ±0.00[c]	14.00-14.00	5	26.65±8.12 [a]	6.28-46.21
40+	4	61.18 ±46.42[a]	8.00-200.20	4	61.18 ±46.42[d]	8.00-200.20	-	-	-

Means sharing a common letter do not differ significantly, others differ significantly ($p< 0.05$).

It has been documented that obesity and insulin resistance are two events which precede *diabetes mellitus*[13, 14]. Much emphasis has been placed upon the effects caused by the disease, and its diagnosis/management through relatively easily available tests, blood glucose and glycated haemoglobin (Hb A1c), Glycemic control in patients was seen to improve as judged from decrease in Hb A1c by administration of insulin alone or combined with antidiabetic drug co-related with plasma glucose level in patients with diabetes[15].

It has also been reported that higher levels of glycated insulin are present in type 2 diabetics[16]. A Korean study[17], has shown that insulin resistance further leads to increased erythropoiesis and subclinical inflammation among elderly.

The combined disruption of eukaryotic translation initiation factors 4E-BP1 and 4E-BP2 in mice has been shown to increase their sensitivity to diet-induced obesity resulting in insulin resistance[10], suggesting that 4E-BP1 and 2 play important roles as metabolic brakes in the development of obesity leading to type 2 diabetes.

It has been shown that globally intake of excess saturated fatty acids is the leading, although modifiable, lifestyle-related cause of insulin resistance and obesity-related diseases in the human population[8], and there is no exception for the Pakistani population. Similarly, diets enriched with saturated fatty acids have shown to impair both glucose tolerance as well as whole-body insulin sensitivity among humans[9].

The use of different types of fat rich diets is very common in the Pakistani population, which is a major cause for the increasing incidences of various non-communicable diseases in the country. Our study has generated preliminary data of fasting serum insulin levels in the local population, and aims to create an awareness that insulin sensitivity needs to be given due recognition in prevention and management of type 2 diabetes.

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