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THE STUDY OF SERUM VITAMIN D STATUS WITH INSULIN RESISTANCE IN OBESE ADOLESCENTS

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ABSTRACT: Aim*:* To study the relationship between serum Vitamin D levels and insulin resistance in obese and non obese adolescents. **Introduction:** Vitamin D deficiency in obese adolescent is strongly associated with increased risk for diabetes, hyper tension and metabolic syndrome. Vitamin D insufficiency is a risk factor for developing impaired glucose in childhood obesity and is associated with insulin resistance in obese adolescents. In our study, we examined the relationship between Vitamin D and insulin resistance in obese adolescents. **Materials and Methods:** The study group included 50 obese adolescent aged (17-19 years) and compared with 50 age and gender matched healthy controls. Anthropometric data were collected and fasting plasma glucose was estimated by (GOD-POD) method, serum Insulin was estimated by (FEIA) method and insulin resistance was calculated by using (HOMA-IR) and serum Vitamin D was measured by using ELISA method. **Results:** The Vitamin D levels in obese adolescents is slightly lower than the controls. The insulin levels in obese adolescents is slightly higher than controls. Insulin resistance was significantly higher in subjects with higher BMI. We found by correlation analysis that HOMA-IR was dependent on degree of obesity and independent of Vitamin D level. **Conclusion:** The study concludes that in obese adolescents insulin resistance was affected more from BMI than Vitamin D levels. Lower concentration of Vitamin D is also a risk factor for developing insulin resistance independent of adiposity.

INTRODUCTION: Vitamin D is an essential micronutrient with major implications for human health [1]. The production of Vitamin D in the skin is directly proportional to the exposure to sunlight and indirectly proportional to pigmentation of the skin [2]. It plays a significant role in glucose homeostasis and insulin secretion by its endocrine role in the pancreas and its paracrine role in adipose tissue. Adolescents seem to be at a higher risk for Vitamin D deficiency than adults.

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Among adolescent groups, 73% girls showed insufficiency , whereas 27% showed severe deficiency.[3] Studies suggest that the prevalence of Vitamin D deficiency varies due to skin pigmentation, diet, socioeconomic status, sunlight exposure and some of the risk factors such as BMI, age, obesity, hip circumference and diabetes mellitus [4, 5]. Individuals with lighter skin pigmentation exposed to similar UVB doses have shown twice the increase in serum vitamin D concentrations compared with those of higher skin pigmentation [6]. Low levels of vitamin D have been associated with higher adiposity and lower HDL [7] as well as a high incidence of type II diabetes mellitus.

Vitamin D may improve glucose stimulated insulin secretion in pancreatic beta cells, which enhances

glucose and lipid metabolism in skeletal muscle. Interference of the Vitamin D metabolism includes the presence of specific Vitamin D receptors (VDRs) on pancreatic β-cells. Due to the deficiency of Vitamin D [8], the presence of a Vitamin D response element in the human insulin gene promoter and presence of VDR in skeletal muscle have been affected and it increases insulin resistance. In addition, Vitamin D directly activates transcription of the human insulin receptor gene, and enhances insulin-mediated glucose transport [9]. The low Vitamin D level has been reported to be associated with insulin resistance in adults [10, 11]. A study was conducted with young healthy male adolescents but no similar study was performed among female adolescent subjects [12]. Hence it was aimed to evaluate the relationship between Vitamin-D and insulin resistance among obese adolescents.

Aims:

1. To estimate the serum Vitamin D levels in obese adolescents.
2. To assess the insulin resistance, The Fasting insulin and Fasting Blood Sugar (FBS) will be measured.

MATERIALS AND METHODS:

Study Group: The study group consisted of 50 obese adolescents and 50 non obese adolescents aged 16-18 years of both sexes. Body Mass Index (BMI) was calculated using the formula (kg/m^2). Obesity was defined as the BMI >97th percentile, described by the international task force of obesity in childhood population.

Inclusion: Adolescent age group of both genders between 16-18 years were included.

Exclusion: The subjects with chronic infection as well as other medical conditions such as genetic syndrome and cancers were excluded

Anthropometric Measurements: Anthropometric measurements such as body weight, height, hip circumference were measured and BMI was calculated.

$$BMI = \frac{\text{Weight in Kg}}{\text{Height in m}^2}$$

Biochemical Measurements: Fasting blood samples were collected and serum Vitamin D was measured by ELISA method [13]. Plasma glucose was measured by using Glucose oxidase-Peroxidase (GOD-POD) method [14], (Auto analyzer-olympus AU-200), Insulin concentration was measured by using Fluorescent Enzyme Immuno Assay(FEIA) and Insulin resistance was calculated by using HOMA-IR (insulin(μg)×glucose(mg) [15].

Statistical Analysis: The statistical significance between obese and non-obese adolescent were analyzed by using Student 't' test and P*<0.005 is considered to be statistically significant. Correlation between Vitamin-D and insulin resistance was calculated by using Pearson's correlation method.

RESULTS: The results of the present study are elaborated in **Table 1** and **2**. **Table 1** indicates the values of BMI, Vitamin D, Blood glucose, Fasting Insulin levels and Insulin resistance in obese adolescents and were compared with non obese controls. The results showed statistically significant alterations in all the above parameters (p*<0.005) except the insulin levels where the P* value is (0.009).

Table 2 depicts the correlation studies between Vitamin D with BMI, Insulin, Insulin resistance levels in obese adolescents**.** It is found that Vitamin D correlated negatively with BMI and Insulin resistance and positively with insulin.

TABLE 1: BIOCHEMICAL PARAMETERS OF OBESE ADOLESCENTS AND NON OBESE CONTROLS:

Parameters	Obese adolescents (n=50)	Non obese controls (n=50)	P* value
BMI (Kg/m^2)	28.78±2.47	23.97±3.04	<0.001
Fasting Blood Sugar (FBS) (mg/dl)	90.94±7.17	82.82±7.88	<0.002
Vitamin D (ng/dl)	16.1±4.29	39.3±9.39	<0.002
Insulin (μg/ml)	17.66±5.66	14.78±1.9	0.009
HOMA-IR(Insulin Resistance)	5.632±1.374	3.614±0.774	<0.003

P* value <0.005, are considered to be statistically significant

TABLE 2: CORRELATION BETWEEN VITAMIN D WITH BMI, INSULIN, INSULIN RESISTANCE LEVELS IN OBESE ADOLESCENTS

Parameters	Mean± SD	Pearson's correlation	P*value
Vitamin D (ng/dl)	16.1±4.29	-0.4721	0.0053
BMI(kg/m^2)	28.78±2.47		
Vitamin D (ng/dl)	16.1±4.29	0.7731	<0.001
Insulin(µg/ml)	17.66±5.66		
Vitamin D (ng/dl)	16.1±4.29	-0.5492	<0.001
Insulin Resistance(HOMA-IR)	5.632±1.374		

P* value <0.005, are considered to be statistically significant

DISCUSSION: The major finding of this study was that, the Vitamin D status in obese adolescents was lower than that of the healthy non-obese control levels. There was an association between the severity of hypovitaminosis D and obesity [16]. The present study had showed that there is a significant negative correlation between obesity and hypovitaminosis. It was reported that hyperparathyroidism has been observed in obese adolescents and found that parathyroid hormone positively and Vitamin D correlated negatively in pre pubertal children[17]. Several authors had concluded that Vitamin D deficiency is the major cause for developing type 2 diabetes mellitus [18]. This study shows that the blood glucose levels among obese and the non obese adolescents had showed significant difference (p* value <0.005).

The insulin resistance is a precursor for the development of type 2 diabetes mellitus in adolescents. Vitamin D is inversely proportional to the insulin resistance which is evidenced in the present study. The insulin level was found to be low when compared to the level of insulin in non obese controls. The results of cross sectional study by Kelly.et.al showed that Vitamin D deficiency is associated with insulin resistance in children even after puberty [19].

The hormonal status during puberty especially in female adolescents might affect glucose metabolism, increase in growth hormone during puberty may contribute to insulin sensitivity [20].

SUMMARY AND CONCLUSION: It may be concluded from the present study that Vitamin D deficiency is more common in obese adolescents. And it leads to insulin resistance, which is a risk factor for type II diabetes mellitus, hence it is advisable for the adolescent population to follow the life style modifications, to avoid health complications.

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