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### RESEARCH ARTICLE

#### A STUDY OF SERUM PHOSPHORUS LEVEL IN PATIENTS WITH DIABETES MELLITUS

**Dr. Divya Chidre<sup>1</sup>, Dr. Manoj Shinde<sup>2</sup> and Dr. Kiran Birari<sup>3</sup>**

1. Junior Resident, Department of General Medicine, SMBT IMS & RC, Dhamangaon, Igatpuri, Nashik, Maharashtra.
2. Junior Resident, Department of General Medicine, SMBT IMS & RC, Dhamangaon, Igatpuri, Nashik, Maharashtra.
3. Associate Professor, Department of General Medicine, SMBT IMS & RC, Dhamangaon, Igatpuri, Nashik, Maharashtra.

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#### Abstract

**Introduction:** Diabetes mellitus is one of the most common chronic metabolic diseases in children and adolescents, which changes the cellular metabolism. Phosphorus is an essential element for metabolism. Early in the progression of diabetes, a paradoxical metabolic imbalance in inorganic phosphate (Pi) occurs that may lead to reduced high energy phosphate and tissue hypoxia. While low and high uncontrolled blood sugars can be easily recognized by clinical symptoms, low and high plasma inorganic phosphate remain unrecognizable. Therefore, we aimed to assess the association between hemoglobin A1c (HbA1c) with serum inorganic phosphate in diabetes.

**Aim:** To study the changes in serum phosphorus levels with severity of DM as adjudged by HbA1c by investigating the following parameters in serum.

1. Blood glucose level (FBS & PPBS)
2. Glycated HbA1c
3. Serum Phosphorus.

**Materials And Methods:** The present study involved 50 healthy controls and 50 clinically diagnosed diabetic cases. Blood samples were collected under aseptic precautions from controls and cases. Relevant investigations were carried out and results interpreted for statistical evaluation.

**Results:** The levels of serum phosphorus decreased in diabetic cases compared to healthy controls. Blood urea and serum creatinine levels were within normal limits in both controls and cases which are statistically not significant.

**Conclusion:** It is concluded that decrease in serum phosphorus level is negatively correlated with glycated HbA1c, indicates that as the severity of diabetes increases there is a significant decrease in serum phosphorus level. Therefore, diabetic treated with insulin should be monitored to prevent morbidity and mortality from hypophosphatemia.

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**Corresponding Author:- Dr. Divya Chidre**

Address:- Junior Resident, Department of General Medicine, SMBT IMS & RC, Dhamangaon, Igatpuri, Nashik, Maharashtra.

### Introduction:-

Diabetes mellitus (DM) is one of the most common chronic metabolic diseases in children and adolescents. 1Hyperglycemia due to absolute insulin deficiency, or a reduction in the biologic effectiveness of insulin or both, causes secondary pathophysiological alterations in multiple organ systems and high mortality and morbidity. 2HbA1c assay is the most commonly used measurement of chronic hyperglycemia in epidemiological studies. 3Achieving near-normal HbA1c levels has been shown to reduce long-term complications and HbA1c assay is recommended to determine the suitability of the treatment. 4DM causes secondary complications such as blindness, kidney damage, cardiovascular disease, and lower-limb amputations. 5These complications are directly due to insulin deficiency, but rather suggest that the changes are related to indirect effects of insulin, like lowering of plasma inorganic phosphate. 6Studies showed that disturbances in the metabolism of inorganic phosphate (Pi) in diabetes leads to early functional microvascular changes in the retina and kidneys. Phosphorus is an essential element for metabolism, because containing compounds have important roles in cell structure (cell membrane and nucleic acids), cellular metabolism (generation of ATP), regulation of subcellular processes (phosphorylation of key enzymes), and maintenance of acid–base homeostasis (urinary buffering). 8 Plasma contains both inorganic and organic phosphates, but only inorganic phosphate is measurable. Pi concentration is an important factor in metabolism and the function of enterocytes, kidney tubular cells, mitochondrial function, muscle function, and oxygen consumption rate. 7,8 When sufficient phosphate and oxygen are not available for adenosine triphosphate (ATP) synthesis, cell homeostasis cannot be maintained and may result in cell lysis. 7 During diabetes progression, a paradoxical metabolic imbalance in Pi occurs that may lead to reduced high energy phosphate and tissue hypoxia. 7,9 In diabetes, elevated blood glucose concentrations depolarize the brush border membrane for Pi reabsorption which leads to hyperphosphaturia. While low and high uncontrolled blood glucose can be easily recognized by clinical symptoms, low and high plasma inorganic phosphate remains unrecognizable. Instead, it may be presented by vague and non-specific symptoms such as tissue hypoxia, muscular weakness, neurological problems, erythrocyte and leukocyte dysfunction, and impaired myocardial performance. 10,12

### Materials And Methods:-

- This Case Control study was carried out at SMBT IMS & RC, Dhamangaon, Ghote, Nashik.
- The present study involved 50 healthy controls and 50 clinically diagnosed diabetic cases.
- After routine informed consent from patient, Blood samples were collected under aseptic precautions from controls and cases.
- HbA1C and Serum Phosphorus levels were done
- The Statistical analysis was done on Microsoft Excel and P value or Chi Square test was done and its significance noted.

### Aim:-

- To study the changes in serum phosphorus levels with severity of DM as adjudged by HbA1c by investigating the following parameters .

1. Blood glucose level (FBS & PPBS)
2. Glycated HbA1c
3. Serum Phosphorus.

### Inclusion Criteria

1. All cases above 18 years of age diagnosed with diabetes Mellitus.

### Exclusion Criteria

1. Patients of chronic kidney disease.
2. Patients of endocrine disorder like hyperparathyroidism.

### Results:-

Serum Phosphorus levels of control and cases are shown in the Table .

Serum phosphorus	Controls	Cases
Decreased (<2.5mg/dl)	0	17 (34%)

Normal(2.5-4.5mg/dl)	50	33(66%)
Increased (>4.5mg/dl)	0	0
Total	50	50

100% of the controls showed normal serum Phosphorus levels in the range of 2.5 -4.5mg/dl and in diabetic cases 34% of them showed decreased level than the normal range i.e. <2.5 mg/dl and remaining 56% of them were in the normal range.

Table shows the mean values of phosphorous levels at different range of glycated hemoglobin levels in diabetic cases.

It is also indicated that there is a distortion between glycated hemoglobin level and serum phosphorus level which is statistically significant .

HbA1c	Number of patients	Serum phosphorous (mean)
Normal	8	3.04
Good Diabetic Control	8	3.61
Fair Control	6	3.17
Poor Control	28	2.63
Total	50	2.92

### Discussion:-

- In our study the mean HbA1c levels for controls is  $4.97 \pm 0.56$  and for diabetic cases is  $8.22 \pm 2.48$ . HbA1c levels are significantly raised in diabetic cases when compared with the controls.
- In our patients of diabetes mellitus it was found that there is decrease in serum phosphorus levels, mean:  $2.92 \pm 0.75$  (P value <0.001).
- Severe hypophosphatemia is manifested with clinical symptoms like dizziness, dysarthria, irritability, confusion and coma.

### Conclusion:-

1. There is a statistical significant effect in FBS, PPBS, Glycated HbA1c of cases as compared with controls.
2. There is a decrease in serum phosphorus levels in diabetes mellitus cases when compared to controls which is statistically significant.

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