

**REVERSE EPIDEMIOLOGY OF BODY MASS INDEX AND ALBUMIN IN DIABETICS PATIENTS WITH END STAGE RENAL DISEASE, EVALUATION OF HYPOALBUMINEMIA IN DIABATIC PATIENTS WITH END STAGE RENAL DISEASE.**

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**ABSTRACT**

**Background:** Hypoalbuminemia is one of the major predictor of mortality in ESRD patients. Several risk factors for hypoalbuminemia have been recognized in ESRD patients including advancing age and female gender. Diabetes mellitus is also found as a risk factor for low albumin in dialysis patients. The problem is under-recognized in our part of the world. In this study, we aimed to establish the incidence of hypoalbuminemia in ESRD with Diabetic patients and to study the correlation between low albumin and body mass index. **Material and method:** It was a cross-sectional study conducted at the Department of Nephrology, Liaquat national hospital Karachi. Patients of either gender who were known diabetic and were having End Stage Renal Disease were included in the study. Those patients who were having liver disease, some known malignancy, and malnutrition were excluded. Data was collected through an interview, a physical examination to measure BMI and a lab test for serum albumin. All the information was recorded in a manual proforma/Excel sheet by the principal investigator. Data analysis: The patient's data was compiled and analyzed through the statistical package for Social Sciences (SPSS) Version 26. The chi-square test / Fisher's Exact test was applied to determine the significance of outcome variables. P value  $\leq 0.05$  was considered significant. **Results:** 109 patients were included. Mean age was 61.4 years. 61 patients were male while 48 were female. Hypertension was noted in 96 patients. Ischemic heart disease was found in 37 patients. Mean height was 1.63 m. Mean weight was 70.40 kg. Mean body mass index was 26.80 kg/m<sup>2</sup>. Mean duration of hemodialysis and duration of ESRD was 2.78 years. We noted hypoalbuminemia in 74 patients and Mean serum albumin was 3.35 g/L. 58 patients had BMI > 24 Kg/m<sup>2</sup> while 51 patients had BMI between 18 to 24 Kg/m<sup>2</sup>. **Conclusion:** Hypoalbuminemia is common in diabetic patients with ESRD. Over weight patients has more hypoalbuminemia. Likewise, low albumin is more prevalent in those patients who commenced on hemodialysis for less than 3 years. Apart from poor nutritional status, presence of hypoalbuminemia in diabetic patients with ESRD may point towards inadequacy of dialysis. Checking serum albumin in diabetic patient with ESRD is recommended to improve nutrition and dialytic therapy in this group of patient.

**KEYWORDS:** Hypoalbuminemia, End Stage Renal Disease, Diabetes Mellitus, Hemodialysis, Body Mass Index.

**INTRODUCTION**

End-stage renal disease (ESRD) is a growing health burden of Pakistan,<sup>[1]</sup> and type 2 diabetes mellitus is the commonest etiological cause of ESRD.<sup>[2]</sup> 20% of type 2 diabetic patients suffer from ESRD during their lifetime,<sup>[3]</sup> while in the USA about 40% of new cases of ESRD are because of diabetic nephropathy.<sup>[4]</sup> Hypoalbuminemia is a major mortality marker in ESRD patients.<sup>[5,6]</sup> Reduced synthesis of albumin has been reported in dialysis dependant patients including hemodialysis and peritoneal dialysis patients.<sup>[7]</sup> Several risk factors have been recognized for low albumin in ESRD patients including advancing age, female gender, and diabetes mellitus.<sup>[8]</sup> The reported incidence of hypoalbuminemia in diabetic patients with end-stage renal disease (ESRD) is 96.4% and is more common in

females (93%) than males (77.6%).<sup>[9]</sup> We, in this study, aimed to determine the incidence and characteristics of low albumin in our diabetic and ESRD population. Our primary end point was to report incidence of the mentioned problem and the secondary end point was to study the relationship of low albumin with BMI. Furthermore, we wanted to establish the effect of duration of ESRD and duration of dialysis on albumin level.

**MATERIAL AND METHOD**

It was a cross-sectional study conducted at the department of Nephrology, Liaquat national hospital Karachi. Study was conducted from February 19, 2022 to August 18, 2022. By taking prevalence of hypoalbuminemia in end stage renal disease patients,

$p=96.4\%$ <sup>7</sup> using margin of error  $d=3.5\%$ , The total calculated sample size was 109 patients with the help of WHO software for sample size calculation taking 95% confidence level. Patients of age 20 to 80 years of either gender who were known diabetic and were having End Stage Renal Disease were included in the study. Those patients who were having liver disease including hepatitis B and hepatitis C were excluded from the study. Similarly, patients with some known malignancy and malnutrition were also excluded. These measures were carried out to avoid confounding effects on the incidence of hypoalbuminemia in diabetic patients with ESRD. Non-probability consecutive sampling was applied as sampling technique. Prior to the start of study, the approval from the institutional ethical committee was taken. Only those patients were enrolled for study who met the inclusion criteria and prior to inclusion written consent was taken. We collected our data through an interview followed by physical examination and then checking the laboratory test for serum albumin level. All the interview and physical examination was performed by principal investigator and all the information was recorded in a manual proforma/ excel sheet by same investigator.

**Verbal interview:** verbal interview of enrolled patients who were coming to dialysis unit of nephrology department, LNH was conducted. Brief history regarding age, diabetes mellitus, hypertension, ischemic heart disease (IHD), presence of ESRD, duration of ESRD, duration of maintenance hemodialysis was taken.

**Checking the BMI:** Metric system was used to report BMI. Weight in kilograms divided by height in meters squared formula was applied. Dry weight of patient was taken to calculate BMI so that confounding effect of inter-dialytic weight gain on BMI could be avoided.

**Checking serum albumin level:** To measure serum albumin concentration, venous samples were taken using

a vacuum technique with a lithium heparin solution container by trained nursing staff. These samples were analyzed by a trained laboratory technician at the central biochemistry lab of the hospital using serum protein electrophoresis technique. Results were obtained through the electronic database system of the central laboratory. Values are enrolled on an excel sheet by the principal investigator.

**Data analysis:** Patient's data was compiled and analyzed through statistical package for Social Sciences (SPSS) Version 26. Frequency and percentage were computed for qualitative variables like gender, hypertension, ischemic heart disease, hypoalbuminemia (Y/N). Mean $\pm$ SD or Median, BMI Height, (inter-quartile range) were calculated for quantitative variable i.e. age, height, weight, BMI, duration of hemodialysis, duration of ESRD and serum albumin. The stratification was done on age, gender, hypertension, duration of ESRD, duration of hemodialysis, IHD, BMI to see the effect of these modifiers on outcome using Chi-square test / Fisher's Exact test. P value  $\leq 0.05$  was considered as significant.

## RESULTS

In this study 109 patients were included to assess the hypoalbuminemia in diabetic patients with end stage renal disease at a tertiary care hospital. Mean  $\pm$  SD of age was  $61.49\pm 9.70$  years. 61 (56.0%) patients were male while 48 (44.0%) were female. Hypertension was noted in 96 (88.1%) patients. Ischemic heart disease was found to be in 37 (33.9%) patients. Mean  $\pm$  SD of height was  $1.63\pm 0.10$  m. Mean  $\pm$  SD of weight was  $70.40\pm 14.34$  kg. Mean  $\pm$  SD of body mass index was  $26.80\pm 5.21$  kg/m<sup>2</sup>. Mean  $\pm$  SD for duration of hemodialysis was  $2.77\pm 2.54$  years. Mean  $\pm$  SD for duration of ESRD was  $2.78\pm 2.54$  years as shown below in table 1:

**Table 1: Baseline characteristics of study variables.**

Variable	Statics
Age (Years)	61.49 $\pm$ 9.70
Duration of hemodialysis (Years)	2.77 $\pm$ 2.54
Duration of ESRD (Yeasrs)	2.78 $\pm$ 2.54
Gender	
Male	61 (56.0%)
Female	48 (44.0%)
Comorbids	
Hypertension	96 (88.1%)
Ischemic Heart Disease	37 (33.9%)
Body Mass Index	
Height (m)	1.63 $\pm$ 0.10
Weight (Kg)	70.40 $\pm$ 14.34
BMI (kg/m <sup>2</sup> )	26.80 $\pm$ 5.21

We noted hypoalbuminemia in 74 (67.9%) patients and Mean  $\pm$  SD of serum albumin was  $3.35\pm 0.63$  g/L. 58 patients had BMI  $> 24$  Kg/m<sup>2</sup> while 51 patients had BMI between 18 to 24 Kg/m<sup>2</sup>. Table: 2

Hypoalbumineia was more prevalent in over weight patients (36.7%), though it was present in normal weight individuals as well (31.2%).

**Table 2: Incidence of hypoalbuminemia and stratification as per BMI.**

Hypoalbuminemia in Diabetic patients with ESRD			
	yes	No	Percentage of affected patients
Hypoalbuminemia	74	35	67.9%
Body Mass Index (Kg/m <sup>2</sup> )			
18 – 24	34 (31.2%)	17 (15.6%)	0.798
>24	40 (36.7%)	18 (16.5%)	

On stratification for the age, we observed that hypoalbuminemia was slightly more common in patients with age above 60 years. But, peoples younger than 60 years also had low albumin. Both male and females were affected but males were slightly more affected than females. 61.4% of hypertensive patients were having

hypoalbuminemia. According to our observation hypertension in the form of chronic illness served as risk factor for hypoalbuminemia in diabetic patients with ESRD. Hypoalbuminemia was more common in ESRD and maintenance dialysis of less than 3 years.

**Table 3: Effect modification of hypoalbuminemia in diabetic patients with ESRD.**

Age Group (Years)	Hypoalbuminemia		p-value
	Yes	No	
29 – 60	34 (31.2%)	16 (14.7%)	0.982
>60	40 (36.7%)	19 (17.4%)	
Gender			
Male	41 (37.6%)	20 (18.3%)	0.865
Female	33 (30.3%)	15 (13.8%)	
Hypertension			
Hypertensive	67 (61.5%)	29 (26.6%)	0.248
Non-Hypertensive	7 (6.4%)	6 (5.5%)	
Duration of Hemodialysis			
0.2 – 2.7 years	53 (48.6%)	15 (13.8%)	0.004
>2.7 years	21 (19.3%)	20 (18.3%)	
Duration of ESRD			
0.2 – 2.7 years	53 (48.6%)	15 (13.8%)	0.004
>2.7 years	21 (19.3%)	20 (18.3%)	

## DISCUSSION

Serum albumin is frequently measured in clinical practice and hypoalbuminemia is often seen in malnourished and severely ill patients.<sup>[9]</sup> Hypoalbuminemia has been reported in patients with AKI,<sup>[10]</sup> CKD and ESRD.<sup>[11]</sup> It increases mortality in all aforementioned groups of patients. We have reported high prevalence of hypoalbuminemia in patients with diabetes and end-stage renal disease (67.9%). Similar findings have been reported in literature across the world for adults as well as for pediatric population.<sup>[12,13]</sup> In one study conducted by Becker BN, et al 44% of patients were diagnosed with hypoalbuminemia.<sup>[14]</sup> Serum albumin has been used as a marker of morbidity in dialysis patients and low serum albumin has found to increase the rate of hospitalization in patients on hemodialysis,<sup>[15]</sup> and it was found to be associated with more severe comorbidity, worse general health status, and protein-energy wasting in maintenance dialysis patients.<sup>[16]</sup> In one study, among different nutritional markers, serum glycated albumin was found to predict mortality and hospitalization better than any other marker.<sup>[17]</sup> Dialysis Outcomes and Practice Patterns Study (DOPPS) conducted at United states claimed that albumin less than 3.5 g/dl is associated with greater risk of death.<sup>[18]</sup> However, in some conditions like anorexia

nervosa, correlation between nutritional intake and serum albumin is poor. Despite low nutritional intake serum albumin is often normal.<sup>[9]</sup> So albumin could be normal with a low BMI. Other face of this fact is a low albumin with a high BMI. Majority of our patients (53.2%) were over weight with a BMI > 24 Kg/m<sup>2</sup> and 36.7% of over weight patients were having hypoalbuminemia. A negative correlation between BMI and albumin in general population, can be seen from review of literature as well, which showed significant low albumin in obese patients in comparison to non-obese patients.<sup>[19]</sup> We noted that most of patients with low albumin were old age and the mean age of patients in our study was 61.49±9.70 years, but previously, hypoalbuminemia has been observed in comparatively young patients as well.<sup>[7]</sup> Risk factors for hypoalbuminemia in dialysis patients include female gender, poor protein intake, albumin loss during dialysis, metabolic acidosis, volume status of patient and presence of chronic inflammation.<sup>[20,21]</sup> One thing differently found in our study is that we have noted hypoalbuminemia slightly more common in male than in female (36.6% vs 30.3%). Chronic inflammation and hence the chronic illness results in reduced albumin synthesis.<sup>[22]</sup> We noted similar correlation between of presence of chronic disease like hypertension and ischemic heart disease and hypoalbuminemia. 61.5% of

hypertensive patients had hypoalbuminemia. We also have observed that duration of dialysis was also affecting serum albumin level. Those who were recently started on hemodialysis were having more hypoalbuminemia in comparison to those who had been on dialysis since more than 3 years. Most of the reported risk factor for low albumin in ESRD patients are reflective of dialysis inadequacy. Further evaluation is required to fully establish the correlation between dialysis inadequacy and hypoalbuminemia.

### CONCLUSION

Albumin and obesity show phenomenon of reverse epidemiology in ESRD patients having diabetes. Hypoalbuminemia is common in diabetic patients with ESRD. Hypoalbuminemia is more common in overweight patients. Also, the low albumin is more common in patients who had been on hemodialysis for less than 3 years. Presence of hypoalbuminemia in this group of patient may point towards inadequacy of dialysis along with poor nutrition status of the patient. Checking serum albumin in diabetic patient with ESRD is recommended to improve nutrition and dialytic therapy in this group of patient.

### Conflict of interest

Author declares no conflict of interest.

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