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**Original Article**

# Impact of Increased Hemodialysis Frequency on Kt/V Achievement in Hemodialysis Patients: A Center-Based Observational Study.

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**Abstract:**

**Introduction**: Chronic kidney disease (CKD) remains a significant global health challenge, necessitating life-sustaining hemodialysis for many individuals. The evidence demonstrates that mortality among ESRD patients is lower when sufficient hemodialysis treatments are provided. The achievement of adequate dialysis dose, measured by Kt/V, plays a pivotal role in improving patient outcomes.

**Method and Material**: This was a center-based descriptive cross-sectional study carried out in Hemodialysis unit of NIKDU, Dhaka, Bangladesh from January 1, 2012, to June 30, 2013, seeks to investigate whether increasing the frequency of hemodialysis sessions to three times per week, totaling 12 hours per week, significantly improves the attainment of target Kt/V in hemodialysis patients when compared to those receiving the conventional regimen of 8 hours per week. Purposive sampling of 120 ESRD patients on maintenance hemodialysis (MHD) getting dialysis for at least one month through Arterio-Venous Fistula (AVF) and at least 2 dialysis session per week.

**Discussion**: Out of 120 patients 72 (60.0%) were male and ratio was 1.5:1. The mean age of hemodialysis patients in this study was 51 years (range: 18-75 years). Most of the patients 62 (52%) were on 8 hours per week hemodialysis session. Our study showed mean Kt/V, URR, TACurea and nPCR of all study population was 1.21 ± 0.40 62 ± 12, 83 ± 26 and 1.29 ± 0.46 respectively. In 8 hours per week hemodialysis group achieved target Kt/V > 2 was only 3(5%) and on the other hand 12 hours per week hemodialysis group achieved target Kt/V > 1.2 was only 26(45%). Among the study population only 52 (43%) achieved URR > 65% , 13 (11%) patients TACurea was less than 52 mg/dl and 107 (89%) patients achieved nPCR > 1 g/kg/day. Mean values of URR was significantly higher of Kt/V of >1.2 and nPCR of >1 g/kg/day group. Most of our hemodialysis patients inadequately dialyzed. In 12 hours per week dialysis group significantly higher BMI, hemoglobin, nPCR and low phosphorus and TACurea. To achieve hemodialysis adequacy of KDOQI 2006 recommendation needs to increase frequency of HD that is 3 sessions per week (12 hours /week) and needs to give more attention to others factors which increase urea clearance.

**Conclusions**: Furthermore, it underscores the need for continuous research to enhance our understanding of hemodialysis adequacy and improve the management of patients with end-stage kidney disease.

**Key words:** Hemodialysis, Kt/V, Chronic kidney disease (CKD), Frequency of hemodialysis, Dialysis dose, Target Kt/V, Renal disease, Nephrology.

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## Introduction:

Chronic kidney disease (CKD) is a pervasive health concern, affecting millions of individuals worldwide. The burden of kidney disease patients requiring renal replacement therapy is increasing day by day.

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Hemodialysis (HD) constitutes the most common form of renal replacement therapy (RRT) worldwide. For those in advanced stages of CKD, hemodialysis serves as a lifeline, assisting in the removal of waste products and excess fluids from the bloodstream. The goal of dialysis in patients with end stage renal disease (ESRD) is to restore body's extracellular and intracellular composition to the greatest extent possible to that of normal. The important of doses measurement of dialysis in clinical practice is the measurement of 'adequacy of dialysis' [1]. The main aims of dialysis treatment are to prolong patient survival, reduce morbidity and improve quality of life. Urea Kinetic Modeling (UKM) is a dialysis method of assessing the appropriate dose of dialysis that determines a maximum clearance of waste products and a good quality of life. Urea kinetic modeling is an important tool for the assessment of dialysis adequacy. Among the patients with end stage renal disease(ESRD) the delivered dose of hemodialysis is an important factor of patient outcome [2] which has been shown to influence survival [3]. The delivered dose of hemodialysis depends on dialysis prescription (duration and frequency of dialysis, dialyser size, dialysate and blood flow rate) and patient factors (size, weight, haematocrit level and vascular access) [4]. The delivered dose of hemodialysis may also be assessed using the URR. The two widely accepted measures of urea clearance are Kt/V, the ratio between the product of urea clearance (K in ml/min) and dialysis session duration (t in minutes) divided by the volume of distribution of urea in the body (V in ml) and URR derived solely from the percentage fall in serum urea (URR) during a dialysis treatment. Whilst Kt/V is a more accurate measure of urea clearance [5,6].

For hemodialysis treatment in patients with end stage chronic renal failure, there is a need for access to provide a repetitive and easy intervention. Dialysis adequacy is an important parameter with regards to morbidity and mortality in chronic hemodialysis patients[7]. Measuring the adequacy of HD is not an easy task. There is no objective, reliable and universally accepted criteria for measuring the adequacy. Dialysis adequacy is not easy to quantify. Clinically, several parameters must be considered to provide adequate dialysis, such as control of fluid overload and electrolytes disturbance, correction of metabolic acidosis and dialysis dose [8]. NKF-DOQI guide lines recommend URR greater than 65% and Kt/V greater than 1.2 which is associated with lower rate of mortality and morbidity. HD for 12 hours/week (4 hours/day for 3 days/week) is the standard and widely accepted regime to achieve adequate HD. But there is a tendency to shorten dialysis time to reduce cost and to increase patients' convenience [9].

Recent studies report some advantages of low-efficiency, frequent schedule over short, high efficiency HD [10, 11]. The present study conducted to find out the hemodialysis adequacy by Urea Kinetic Modeling (UKM) among the Bangladeshi patients on maintenance hemodialysis therapy. This study will enrich our knowledge about the hemodialysis adequacy in our population and thus help in the management of patients of end stage kidney disease (ESRD).

**Methods and Materials:**

This was a cross sectional study, conducted at hemodialysis unit of National Institute of Kidney Diseases and Urology (NIKDU), Dhaka, Bangladesh. The study was conducted between the periods of 1st Jan' 2012 and 30th Jun' 2013. A structured questionnaire was prepared to determine socio-demographic characteristics (such as age, sex, marital status, social background, socioeconomic status, education, occupation, etc), Relevant history (Measurement of height, weight , pre-dialysis and post-dialysis), physical examination (blood pressure, Body mass index (BMI) was calculated from formula, BMI= postdialysis weight (kg)/height$^2$ ($m^2$) ) and Laboratory investigations (Complete blood count – CBC, Blood urea, serum creatinine, serum electrolytes, Serum calcium, serum phosphate, Serum albumin, total protein)and hemodialysis adequacy parameters were done among the study population only once at the entry into this study. Total 120 samples included in the study using purposive sampling method. All of them were evaluated for End-Stage Renal Disease (ESRD) patients on maintenance hemodialysis (MHD). Only one

session of dialysis was observed and three sample taken (predialysis , postdialysis and next predialysis). Kt/V, URR, TACurea and nPCR were calculated from predialysis, postdialysis, next predialysis blood urea and interdialytic urinary urea excretion. Absence of residual renal function (RRF), defined as a urine volume ≤200 ml/24 h (Pre dialysis day) (Louise et al. 2000). So, patients who have 24 hours urine volume < 200 ml were taken as no residual renal function in this study. Mean of clinical, biochemical and adequacy parameters were calculated and compared between twice and thrice per week hemodialysis groups. Also compared various clinical, biochemical and adequacy variables between groups who achieved cutoff values of URR, TACurea and nPCR with who not achieved it. Ethical issues were maintained properly and data analysis was done by using SPSS (Statistical Package for Social Sciences).

**Results and observation:**

This was a center based cross sectional study to see the Impact of Increased Hemodialysis Frequency on Kt/V Achievement in Hemodialysis Patients. Total 120 patients were included. They were on maintenance hemodialysis (MHD) treatment for at least one month through AVF.

**Demographic data:**

- **Age and gender:**

Out of 120 patients 72 (60.0%) were male and 48 (40.0%) were female. Male female ratio was 1.5:1. The mean age of prevalent hemodialysis patients in this study was 51 years (range: 18-75 years). Among the patients 14 (11.7%) were in the age group of less than 30 years, 13 (10.8%) were in the age group of 31 to 40 years, 20 (16.7%) were in the age group of 41 to 50 and rest and the highest number of patients were in the age group of more than 60 years.

**Table 1: Distribution of age and gender of the study population.**

| Variables | Frequency | Percentage |
|---|---|---|
| **Gender** | | |
| Male | 72 | 60.0 |
| Female | 48 | 40.0 |
| Male to female ratio | 1.5:1 | |
| **Age group** | | |
| <30 | 14 | 11.7 |
| 31-40 | 13 | 10.8 |
| 41-50 | 20 | 16.7 |
| 51-60 | 34 | 28.3 |
| >61 | 39 | 32.5 |

**Clinical data:**

**Hemodialysis time per week:**

Most of the patients (52%) were on 8 hours per week hemodialysis session.

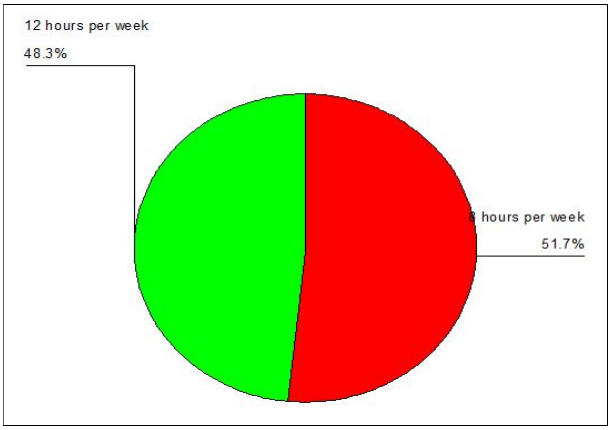


**Figure 1: Hemodialysis time per week.**

- **Clinical and Laboratory Parameters:**

Above table shows theclinical parameters of hemodialysis (HD) patients including age, body mass index (BMI), hemodialysis duration and biochemical variables like hemoglobin, creatinine, potasium, calcium, phosphorus, serum albumin, Urea Reduction Ratio (URR), single session spKt/V, weekly Kt/V, TAcurea and nPCR and residual renal urea clearance.

**Table 2: Clinical and biochemical data of all hemodialysis patients. (N=120)**

| Variables | Mean ± SD |
|---|---|
| Age (years) | 51 ± 14 |
| Body Mass index (kg/m2) | 23 ± 4 |
| Hemodialysis duration (month) | 23 ± 19 |
| Hemoglobin(gm/dl) | 9.4 ± 2.0 |
| Creatinine (mg/dl) | 9.6 ± 2.9 |
| Albumin(g/dl) | 3.5 ± 0.5 |
| Calcium (mg/dl) | 9.2 ± 1.0 |
| Phosphorus (mg/dl) | 5.4 ± 2.0 |
| Urea Reduction Ratio (URR) % | 62 ± 12 |
| Single session spKt/V | 1.21 ± 0.40 |
| Weekly Kt/V (Calculated) | 3.00 ± 1.13 |
| TACurea(mg/dl) | 83 ± 26 |
| nPCR(g/kg/day) | 1.29 ± 0.46 |
| Residual renal urea clearance (ml/min, n=21) | 1.87 ± 1.26 |

- **Comparison of hemodialysis adequacy parameter mean values with target value.**

Mean URR of study population significantly lower than target value. Kt/V of 8 hours per week hemodialysis group significantly lower than target value but no significant different in 12 hours per week hemodialysis group at 95% confidence interval. Mean TACurea significantly higher than target value (<52 mg/dl). Mean PCR significantly higher than target value.

**Table 3: Comparison of sample mean value with target value.**

| Adequacy parameters | | Sample mean values | Target values | 95% Confidence Interval |
|---|---|---|---|---|
| URR (%) (N=120) | | 62 ± 12 | ≥ 65 | 59.70 – 64.03 |
| Kt/V (N=120) | 8 hours/ week (n=62) | 1.24 ± 0.41 | ≥ 2 | 1.14 – 1.35 |
| | 12 hours/week (n=58) | 1.18 ± 0.39 | ≥ 1.2 | 1.08 – 1.28 |
| TACurea (mg/dl) (N=120) | | 83 ± 26 | < 52 | 78.52 – 88.00 |
| nPCR (g/kg/day) (N=120) | | 1.29 ± 0.46 | ≥ 1 | 1.20 – 1.37 |

- **Distribution ofstudy population on the basis of cut off values of adequacy parameters of UKM.**

Among the 62 patients in the group of 8 hours per week hemodialysis only 3(5%) had Kt/V more than 2 and 59 (95%) had Kt/V less than 2. Among the 58 patients in the group of 12 hours per week hemodialysis 26 (45%) had Kt/V more than 1.2 and 32(55%) had Kt/V less than 1.2. Among 120 patients only 52 (43%) achieved URR ≥ 65%, 13 (11%) patients achieved TACurea was less than 52 mg/dl and 107 (89%) patients achieved nPCR≥ 1 g/kg/day.

**Table 4: Distribution ofstudy population on the basis of cut off values of hemodialysis adequacy parameters.**

| Adequacy parameters | | Cut off values | Mean values | Frequency | Percent |
|---|---|---|---|---|---|
| URR (N=120) | | ≥65% | 72 ± 6 | 52 | 43 |
| | | <65% | 53 ± 9 | 68 | 57 |
| Kt/V | 8hrs/week (n=62) | ≥2 | 2.49 ± 0.59 | 3 | 5 |
| | | <2 | 1.18 ± 0.29 | 59 | 95 |
| | 12hrs/week (n=58) | ≥1.2 | 1.54 ± 0.25 | 26 | 45 |
| | | <1.2 | 0.89 ± 0.18 | 32 | 55 |
| TACurea (N=120) | | <52 | 43 ± 9 | 13 | 11 |
| | | ≥52 | 88 ± 23 | 107 | 89 |
| nPCR (N=120) | | ≥1 | 1.48 ± 0.38 | 86 | 72 |
| | | < 1 | 0.76 ± 0.15 | 34 | 28 |

- **Comparison between 8 hours and 12 hours per week hemodialysis groups.**

Sixty two patients were on 8 hours/week of hemodialysis and 58 on 12 hours/week. Both groups were matched for age. The body mass index (BMI) was lower in twice weekly dialyzed group (22.5±3.7 vs. 24.4±3.9, kg/m$^2$, p=0.007). There was no significant difference in single session spKt/V but when calculated weekly Kt/V which was significantly higher in 12 hours per week group.

**Table 5: Comparison of clinical and biochemical parameters between 8 hours and 12 hours per week hemodialysis groups.**

| Variables | Hemodialysis 8 hour/week (n=62) | Hemodialysis 12 hour/week (n=58) | P value(95% confidence interval) |
|---|---|---|---|
| Age (years) | 50 ± 15 | 53 ± 13 | 0.319(-7.81-2.56) |
| Body Mass index (kg/m$^2$) | 22.5±3.7 | 24.4±3.9 | 0.007(-3.32- -0.53) |
| Hemoglobin(g/dl) | 8.9 ± 1.9 | 10.0 ± 2.0 | 0.002(-1.65- -0.41) |
| Serum Albumin(g/dl) | 3.6 ± 0.5 | 3.5 ± 0.5 | 0.393(-0.11-0.28) |
| Serum Calcium (mg/dl) | 9.3±.8 | 9.2±1.3 | 0.778(-0.34-0.46) |
| Serum Phosphate (mg/dl) | 5.8 ± 1.9 | 5.0 ± 2.0 | 0.031(0.07-1.52) |
| Urea Reduction Ratio(URR%) | 63 ± 11 | 61 ± 12 | 0.293(-2.03-6.64) |
| Single session spKt/V | 1.24 ± 0.42 | 1.18± 0.39 | 0.392(-0.82- -0.21) |
| Weekly Kt/V(Calculated) | 2.49 ± 0.84 | 3.55 ± 1.17 | 0.001(-1.43 - -0.68) |
| TACurea (mg/dl) | 91 ± 25 | 75±25 | 0.001(6.40-24.56) |
| nPCR (g/kg/day) | 1.2 ± 0.4 | 1.4± 0. 5 | 0.007(-0.39- -0.65) |

## Discussion:

The present study aimed to investigate the impact of increased hemodialysis frequency on Kt/V achievement in hemodialysis patients. Dialysis adequacy is an important parameter with regards to morbidity and mortality in chronic hemodialysis patients[7]. Hemodialysis adequacy is a crucial factor in the management of chronic hemodialysis patients, as it plays a significant role in determining patient survival, reducing morbidity and improving their overall quality of life. The delivered dose of dialysis can affect morbidity and mortality of dialysis patients. Inadequate dialysis accounts for the high mortality in patients with end stage renal disease (ESRD). Due to various factors including financial and logistic limitations, hemodialysis is mostly performed twice-a-week [1]. In this study, the researchers explored the differences in Kt/V achievement between patients undergoing 8 hours of hemodialysis per week and those receiving 12 hours per week.
The present study was conducted to determine hemodialysis adequacy by Urea Kinetic Modeling (UKM). It conducted to observe optimum solute clearance per session of hemodialysis by measuring pre and postdialysis blood urea and applying Kt/V and URR formula and to measure the Time Average Concentration of urea (TAC urea) and to assess normalized Protein Catabolic Rate ( nPCR).

Among the patients of presenting study nearly 60% belonged to more than 50 years age group (table 1). Other studies also found that majority dialysis patients are in the age around 50 years. A studyin Nepal showed that the mean age of the patients was 49±24 years[1].Another study in Sudan showed that the median age of prevalent HD patients was 45 years[12].Out of 120 patients 60% were male (table 1). Mean duration of dialysis (month) was 23 ± 19 (range 2 - 124) (Table 2). A studyin Nepal, reported that out of 60 patients, 40 were male[13]. Another study in Nepal showed that mean duration of hemodialysis of 13.5 ± 8.5 months[1].

In our study diabetic nephropathy (DN) was the leading cause (48%) of ESRD requiring dialysis (Figure 1). A study in Pakistan showed that diabetes was the major cause of renal disease in 38.4% of the study population[14]. The USRDS data base showed in majority countries DN is the leading cause [15]. Higher prevalence of diabetic nephropathy in our study due to more aged patients.

In the presenting study 52% patients was on 8 hours per week hemodialysis (Figure 5) in spite of the mean residual renal urea clearance was <2 ml/min(Table 4). Anees et al. (2011)[14] in their study showed that 1, 2 and 3 per week dialysis were 7.2%, 77.6% and 15.2% respectively. Twice-weekly HD is prevalent in the developing countries and the clinical outcome of this population remains to be elucidated[16]. Thrice-weekly HD is regarded as a standard renal replacement therapy (RRT) for maintenance dialysis and the KDOQI guidelines, 2006 indicates that twice-weekly

hemodialysis is not appropriate in patients who have residual renal function <2 ml/min/1.73 m [217]. Because of mean residual renal urea clearance <2 ml/min/1.73 m [2] and only 5% percent of patients had residual renal urea clearance >2 ml/min/1.73 m [2]. So subsequent analysis was ignored urinary contribution of Kt/V, TACurea and nPCR.

Our study showed mean spKt/V, URR, TACurea and nPCR of all study population was 1.21 ± 0.40 62 ± 12, 83 ± 26 and 1.29 ± 0.46 respectively (table 4). In 2013, a study in Finland showed TAC urea (mmol/L) was 17.7 ± 5.2 and nPCR was (g/kg/day)1.09 ± 0.27 (Range 0.48-2.34)[18] and inGermany, they showed mean nPCR was 1.1 ± 0.3[19]. A cross-sectional study done in 2011 of 40 Bangladeshi patients to see effect of surface area of dialyzer membrane on the adequacy of haemodialysis and reported mean URR and Kt/v were 45.9 ± 3.03 and 0.76±0.09 respectively[9]. They found that urea clearance was better in higher dialyzer surface area group. In their study dialyzer surface area was 1.2 $m^2$. Our dialyzer surface area mean was 1.6 $m^2$ (Range 1.3-2.1 $m^2$). Annual Data USRDS of 2002 reported that there has been an improvement in mean spKt/V from 1.3 in 1994 to 1.5 in 2002. Importantly, the proportion of patients with spKt/V below 1.2 decreased from 40% to 18% over this same period. The proportion of patients with spKt/V more than or equal to 1.6 increased from 13% to 36%. This improvement could be attributed to the use of higher prescribed blood flow rates. The use of dialyzers with larger KoA's may also have contributed.

In this study URR $\geq$ 65%, TACurea $\leq$ 52 mg/dl and nPCR $\geq$ 1 g/kg/day were 43%, 11% and 72% respectively. 8 hours per week hemodialysis group achieved Kt/V $\geq$ 2 only 5% and on the other hand 12 hours per week hemodialysis group achieved Kt/V $\geq$ 1.2 only 45% (table 7). In 2004, a study done by Erwin Hecking over the five European countries on 3039 patients shown, spKt/V < 1.2 of thrice per week dialysis patients was 16%, 40%, 34%, 35%, 28% and 30% of France, Germany, Italy, Spain, UK and all study population respectively[20]. The NECOSAD study shown, mean haemodialysis treatment time was 10.29 $\pm$ 1.97 h/week (3 sessions /week)[21]. Mean spKtV 1.18 $\pm$ 0.26 and URR 63 $\pm$ 8%. Similar mean spKtV and URR was found in our study (table 4) .Their target aims for adequate haemodialysis dose was spKt/V $\geq$1.4 and URR $\geq$70%. In 161 (19%) of the patients, spKt/V dialysis dose was at or above the target range, without taking into account residual renal function. When URR was used in the cohort of 830 patients, 160 (19%) patients had a dialysis dose at or above the target range. They also shown 478 (58%) patients had URR < 65% and 456 (55%) had spKt/V <1.2. Our finding was also similar to this study (table 5). In 2011, a multicenter national Study of total of 4004 Iranian patientsshowed the mean blood flow rate was 242.9 ± 39.2 mL/min[22]. The mean length of hemodialysis session was 229.2 ± 22.2 minutes. The mean urea reduction ratio (URR) and Kt/V were 61.0 ± 11.8% and 1.2 ± 0.4, respectively. A Kt/V less than 1.2 and a urea reduction ratio (URR) less than 65% were found in 56.7%, and 65.2% of the hemodialysis patients respectively. We also found same result. In Nepal, a study from 186 sessions of dialysis of 60 patients of 2 per week dialysis schedule shown mean predialysis urea, postdialysis urea and spKt/V were 160± 51.2 mg/dL, 71.8 ± 28.5 mg/dL and 0.95±0.28 respectively[23]. Mean URR was 54.82±11.24%. Out of total 186 sessions, spKt/V was $\geq$ 1.2 in only 31 sessions (17.0%). In our study spKt/V of 8 hours per week hemodialysis target was $\geq$ 2.

Sixty two patients in this study were on 8 hours/week of hemodialysis and 58 on 12 hours/week. Both groups were matched for age. The body mass index (BMI) was lower in twice weekly dialyzed group (22.5±3.7 vs.24.4±3.9, $kg/m^2$, p=0.007**)**. Hemoglobin in patients with 12 hours per week hemodialysis was significantly higher (p=0.002) in comparison with the patients with 8 hours per week hemodialysis. Phosphorus and TACurea in patients with 8 hours per week hemodialysis was significantly higher (p value 0.0312 and 0.001 respectively) in comparison with the patients with 12 hours per week hemodialysis. The nPCR was higher in patients with 12 hours per week hemodialysis in comparison with the patients with 8 hours per week hemodialysis (p = 0.007).

There was no significant difference in single session spKt/V and URR but when calculated weekly Kt/V which was significantly higher in 12 hours per week group (table 7).Data from Thailand shown, there was no difference for nutrition status between patients with twice-weekly HD and those with thrice-weekly HD provided that these two groups had similar weekly Kt/V of over 3.6[24]. They found weekly sum of spKt/V in patients in the thrice-weekly HD group was significantly greater compared with patients in the twice-weekly HD group (5.21 ± 0.85 vs. 4.67 ± 0.60, respectively, p < 0.001). No significant differences were observed for BMI. Thrice-weekly HD patients had a low DPI (g/kg/day), nPCR (g/kg/day), serum albumin(g/dl), serum calcium (mg/dl), serum phosphorus (mg/dl) but no statistically significant difference (0.89 ± 0.38 vs 1.06 ± 0.46, 1.03 ± 0.21 vs 1.06 ± 0.22, 4.10 ± 0.43 vs 4.22 ± 0.46 , 9.87 ± 0.97 vs 10.03 ± 0.89 , 4.97 ± 1.64 vs 5.18 ± 1.47, p > 0.05 respectively). Our study result was similar to this nPCR and values of spKt/V and weekly Kt/V was lower than this study, as because their inclusion criteria was weekly Kt/ V> 3.6. In the National Cooperative Dialysis Study (NCDS), a PCR greater than 1 g/kg per day and a timed average urea concentration of 50 mg/dL (18 mmol/L) were associated with low morbidity[25]. A study done in Shanghai (2012) showed that patients on the twice weekly HD patients had significantly higher single-pool Kt/V (spKt/V)[16].InChina, a cohort study of 2,572 patients; shown the twice weekly HD patients had significantly, higher single-pool Kt/V (1.65 ± 0.45 vs 1.39 ± 0.47; p= 0.001) but weekly Kt/v significantly lower in the twice weekly HD patients (3.29 ± 0.91 vs 4.17 ± 1.41; p=0.001)[26]. Mean URR of twice and thrice weekly group were 72.1 ± 8.5 and 66.3 ± 9.6 respectively which was significantly higher in twice per week dialysis group. In our study spKt/V and URR higher in thrice weekly (12 hours/week) hemodialysis group but not significant. Similar study over 74 Taiwan patients (23 twice weekly and 51 thrice weekly dialyzed patients) shown no significant different of serum albumin, nPCR, URR and single session spKt/V between 8 hours week and 12hours week dialysis(3.99 ± 0.25 vs 4.06 ± 0.30 p 0.266; 1.37 ± 0.27 vs 1.45 ± 0.25 p 0.222; 77.77 ± 5.44 vs 75.47 ±6.27 p 0.114 and 1.53 ± 0.26 vs 1.45 ±0.25 p 0.194 respectively)but weekly dialysis Kt/V significantly higher in 12 hours per week dialysis group (2.99 ± 0.45 vs 3.37 ± 0.42 ; p.0.002)[27].

This study showed in 12 hours per week hemodialysis group showed only URR% was significantly higher in patients with spKt/V ≥1.2 but BMI significantly higher in patients with spKt/V <1.2(table 9) and in 8 hours per week hemodialysis group showed URR% was significantly higher in patients with spKt/V ≥2 but serum calcium better maintain in patients with spKt/V <2 (table 8).In Serbia, the study of 140 patients on thrice per week hemodialysis, 44(32%) patients received the recommended hemodialysisdose (spKt/V ≥ 1.2) and 96 (68%) patients received non-adequate hemodialysis dose (Kt/V < 1.2)[28]. Those with non-adequate HD had lower concentrations of hemoglobin than the group with Kt/V ≥ 1.2 (98.5 ± 15.6 vs. 107 ± 14.9 g/L; p = 0.047). The mean concentrations of potassium (5.1 ± 0.49 vs. 5.5 ± 0.76 mmol/L; p = 0.038) and C-reactive protein (1.8 ± 3.4 vs. 3.55 ± 23.6 mg/L; p = 0.048) were lower in the group of patients with adequate HD, Regarding total serum protein (69 ± 4.63 vs. 65 ± 5.74 g/L; p = 0.02) and albumin (38 ± 2.99 vs. 29 ± 4.4 g/L; p = 0.047), there were also significant differences between the groups of patients favoring those with an adequate index of HD.

In this study hemoglobin,albumin, Kt/V, URR shown significantly better in nPCR more than 1 g/kg/day group and phosphorus and TACurea were significantly higher in the group with less than 1 g/kg/day . nPCR less than 1 g/kg/day group more aged patients (table 12). A study on 22 Turkey's maintenance hemodialysis patients were on 3 sessions per week dialysis and observed six months shown only serum albumin significantly higher in patients with nPCR > 1 g/kg/day than in patients with nPCR <1 g/kg/day (4.3± 0.36 vs 3.8±0.5; p value=0.014)[29]. They not found significantly difference of age, BMI, phosphorus, hemoglobin and spKt/V between the study groups. In our study both 8 hours and 12 hours per week hemodialysis included and a cross sectional study.

**Conclusion:**

Most of our hemodialysis patients inadequately dialyzed. Only 3(5%) of 8 hour per week dialysis and 45% of 12 hours per week dialysis hemodialysis patients were achieved target spKt/V. In 12 hours per week dialysis group significantly higher BMI, hemoglobin, nPCR and low phosphorus and TACurea and better control of predialysis BP but no significant different in spKt/V. Only 13(11%) achieved target TACurea<52mg/dl, 86 (72%) nPCR>1 g/kg/day and 43% patients achieved URR $\geq$ 65%. To achieve hemodialysis adequacy of KDOQI 2006 recommendation needs to increase frequency of HD that is 3sessions per week (12 hours /week).

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