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# The study some changes biochemical parameters in patient's renal failure in before and after haemodialysis program.

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**Abstract:**

This study was designed to investigate changes in some biochemical parameters (urea, creatinine, sodium, potassium) at the end stage of renal disease (ESRD) patient on convenintial haemodialysis program.

The study was included collected of one hundred and thirteen (113) samples. Eighty-three (83) patients with end stage renal disease on haemodialysis program including (47) males and (36) females with a mean age of (43.3±18.0) years and range from (20-65) years. All the patients had been on dialysis twice per week for two hours each time. In addition, thirty from apparently healthy volunteers as control.

The subjects were fasted for twelve hours and the samples were drowning 30 minutes before haemodialysis and 30 minutes after haemodialysis.

This study showed highly significant differences in urea and creatinine concentrations before and after haemodialysis and when compared with control (before haemodialysis with control and after haemodialysis with control). The significant changes exist when the patients grouped according to gender (male and female) and age [(20-35), (36-50) and (51-65) years].

The electrolytes were varied in their changes. There was non-significant difference in sodium concentration except significant change in before and after haemodialysis when compared each with control; while potassium showed a highly significant changes except when pre dialysis compared to control and in the last two age groups (36-50) and (51-65) years in which there were no significant difference.

**Keywords:** Haemodialysis, urea, creatinine, sodium, potassium.

## Introduction:

The kidneys are bean-shaped organs, each about the size of a fist. They are located near the middle of the back, just below the rib cage, one on each side of the spine. The kidneys are sophisticated reprocessing machines. Every day, a person's kidneys process about 180 litter of blood to shift out about 1.5 litter of waste products and extra water. The wastes and extra water become urine [١]. They perform several important functions within the human body, such as cleaning the blood and waste products of the body, getting rid of the extra fluids in the body through the urine and helping in the production of red blood cells.

They also help in the processing of renin, which is used to regulate the blood pressure, and in the processing of Vitamin D, which helps in the absorption of calcium and phosphorus in the body. It is obvious that the kidneys perform a very important function in the human body, and their failure can be very disastrous for the individual. Impaired renal function has adverse effects on blood chemistry, blood pressure, fluid balance, nutrient intake, and the person's general state of health.

Renal failure is a condition in which the kidneys stop working and are not able to remove waste and extra water from the blood or keep body chemicals in balance. Acute kidney injury (AKI), previously called acute renal failure (ARF), is a rapidly progressive loss of renal function and may resolve. Chronic renal failure has a slow onset, may follow episodes of acute renal failure, and is not reversible. Chronic renal failure often results from acute glomerulonephritis or pyelonephritis. Other reasons for chronic renal failure include diabetes mellitus, atherosclerosis of the renal blood vessels, hypertension, polycystic kidney disease, and kidney stones [2].
End-stage renal disease (ESRD) is the final stage of kidney failure that is marked by the complete or nearly complete irreversible loss of renal function [3].

An irreversible and usually progressive reduction in renal function in which both kidneys have been damaged by a variety of diseases to the extent that they are unable to adequately remove the metabolic products from the blood and regulate the body's electrolyte composition and acid-base balance [2].

The most common signs of chronic kidney disease are need to urinate more often or less often, feel tired, lose their appetite or experience nausea and vomiting, have swelling in their hands or feet, feel itchy or numb, have darkened skin, have muscle cramps. There is no specific treatment unequivocally shown to slow the worsening of chronic kidney disease (CKD). Severe CKD requires one of the forms of renal replacement therapy; this may be a form of dialysis, but ideally constitutes a kidney transplant [4].

Dialysis is the process of cleaning wastes from the blood artificially. The two major forms of dialysis are haemodialysis and peritoneal dialysis. Haemodialysis removes waste and excess fluid from the blood when the kidneys cannot do so sufficiently. The blood is drawn intravenously, sent through a machine called a dialyzer, and returned to the body through a blood vessel. Inside the dialyzer, the blood is passed over a membrane that filters waste and fluid into a dialysate solution. The dialysate is then pumped out to a disposal tank and new dialysate is pumped in.

**Aims of the study:**

This study aims to detection biochemical changes as (urea, creatinine, sodium and potassium) in patients with haemodialysis.

**Material and Method:**

Blood samples were collected from patients in artificial kidney unit of Al-Abbas general hospital in Wasit governorate**.** A (83) blood samples were obtained from males and females and divided in males (47) and females (36).
5ml blood samples were collected in normal plain tubes. The serum separated by centrifugation at 3000g for 30 minutes. The samples were analysed in laboratory of Al Karama teaching hospital to determine biochemical parameters such as urea, creatinine, sodium and potassium in serum.
Estimation of serum creatinine

The creatinine levels in the samples were assessed by Jaffe Kinetic assay. Creatinine in the serum sample reacted with picric acid in an alkaline solution (i.e., alkaline picrate) of the reagent and developed an orange coloured complex. The quantity of creatinine in the test samples was calculated against the intensity of the colour developed during the fixed time. The intensity of the colour was measured using a spectrophotometer.

**Estimation of serum urea**:

Urea levels in the samples were hydrolysed by urease to form ammonium and carbonate. Next, L-glutamate was produced by the reactions between ammonium and 2-oxoglutarate in the presence of glutamate dehydrogenase and the coenzyme NADH. During this reaction, two moles of NADH were oxidized to NAD+ for each mole of urea hydrolysed. The rate of decrease in the NADH concentration was directly proportional to the urea concentration in the serum sample, which was photometrically determined.

**Estimation of serum sodium:**

Sodium is precipitated with Mg –uranyl acetate, the uranyl ions remaining in suspension form a yellow-brown complex with thioglycolic acid. The difference between reagent blank (without precipitation of sodium) and analysis is proportional to the sodium concentration.

**Estimation of serum potassium:**

Potassium ion in a protein –free alkaline medium react with sodium tetraphenylboron to produce a finely dispersed turbid suspension of Potassium tetraphenylboron. The turbidity produced is proportional to the potassium concentration and read photometrrically.

**Statistical Analysis:**

The statistical analysis proceeded in this study, descriptive statistic analyzed by using one-way analysis of variance (ANOVA) were performed using means and standard deviation (SD) with LSD test for continuous variable ($p > 0.05$) was considered to be significant, and $X^2$, (p-value 0.01) was considered to be significant. All analyses were performed with the Statistical Package for the Social Sciences SPSS software.

**Results and discussions:**

Result in table (1) represented the changes of urea and creatinine among patient before and after H.D. The table shows that there were a highly significant difference (decrease) (P-value<0.01) in the mean of urea (24.198±7.524) before haemodialysis when comparison with urea (15.781±7.987) after haemodialysis. The table also showed that there were decrease in the mean of creatinine (689.795±203.992) before haemodialysis compared to creatinine (497.072±246.141) after haemodialysis with a highly significant difference (P-value<0.01). These results were in agreement with the study of Abdoljalal Marjani et al (2006) [5]

**Table 1**: **Changes of urea and creatinine among patients before and after H.D.**

| Parameter | N | Mean | SD | Comparison of significant | |
|---|---|---|---|---|---|
| | | | | P - value | Sig. |
| Urea before H.D | 83 | 24.1980 | 7.52472 | .0005 | H.S |
| Urea after H.D | 83 | 15.7818 | 7.98778 | | |

| | | | | | |
|---|---|---|---|---|---|
| Creat before H.D | 83 | 689.7952 | 203.99299 | .0005 | H.S |
| Creat after H.D | 83 | 497.0723 | 246.14116 | | |

Result in table (2) shows that there was a highly significant decrease (P-value<0.01) between Potassium concentration before and after haemodialysis, the mean decrease from (4.214±1.726) before haemodialysis to (3.198±1.357) after haemodialysis. The table also showed that there was no significant difference (P-value>0.05) between sodium concentration before and after dialysis. The above observations were in agreement with the result of Barry Kirschbaum et al (2003) [6].

**Table 2: Changes of sodium and potassium among patient before and after H.D.**

| Parameter | N | Mean | SD | Comparison of significant | |
|---|---|---|---|---|---|
| | | | | P - value | Sig. |
| Sodium before H.D | 83 | 126.3369 | 19.61099 | .598 | N.S |
| Sodium after H.D | 83 | 127.2810 | 18.29189 | | |
| Potassium before H.D | 83 | 4.2146 | 1.72685 | .0005 | H.S |
| Potassium after H.D B | 83 | 3.1981 | 1.35713 | | |

Data presented in table (3) shows that there was an increase in the urea concentration before haemodialysis (24.198±7.524) compared to control (5.424±1.112) with a highly significant (P-value<0.01). Beside, the same table showed a highly significant (P-value<0.01) increase between creatinine concentration before haemodialysis (689.795 ±203.992) and control (74.310±13.408). These results were in agreement with the observation of Ehab Ismail Mohamed et al [7] and Narinder Maheshwari et al [8].

**Table 3: Changes of urea and creatinine between patient before H.D and control.**

| Parameter | | N | Mean | SD | Comparison of significant | |
|---|---|---|---|---|---|---|
| | | | | | p-value | Sig. |
| Urea | Before | 83 | 24.1980 | 7.52472 | .000° | H.S |
| | Control | 30 | 5.4247 | 1.11261 | | |
| Creat | Before | 83 | 689.7952 | 203.99299 | .000° | H.S |
| | Control | 30 | 74.3107 | 13.40813 | | |

Data presented in table (4) shows that there was a significant decrease between sodium concentrations (126.336±19.610) in ESRD patient before haemodialysis and control (133.377±10.049) and this result were in agreement with the observation of Erkan Dervifloğlu et al [9].However, there was no significant difference between potassium concentrations (4.214±1.726) in ESRD patient before haemodialysis and control (4.183± 0.762) and this result were in agreement with the observation of Isa Durmaz et al [10].

**Table 4: Changes of sodium and potassium between patient before H.D and control.**

| Parameter | | N | Mean | SD | Comparison of significant | |
|---|---|---|---|---|---|---|
| | | | | | p- value | Sig. |
| Sod | Before | 83 | 126.3369 | 19.61099 | .014 | S |
| | Control | 30 | 133.3770 | 10.04991 | | |
| | Before | 83 | 4.2146 | 1.72685 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Pot | Control | 30 | 4.1830 | .76207 | .923 | N.S |

Result in table (5) represented the changes of urea and creatinine among patient after H.D in comparison to control. The table shows that there was a highly significant difference (P-value<0.01) in the concentration of urea (15.781±7.987) after haemodialysis when comparison with control (5.424±1.112). The table also showed that there was a highly significant difference (P-value<0.01) in the concentration of creatinine (497.072 ±246.141) after haemodialysis compared to control (74.310±13.408). These results were in agreement with the observation of Ali Monfared et al [11].

**Table 5: Changes of urea and creatinine concentration in-patient after H.D compared to control.**

| Parameter | | N | Mean | SD | Comparison of significant | |
|---|---|---|---|---|---|---|
| | | | | | P - value | Sig. |
| Urea | After | 83 | 15.7818 | 7.98778 | .000ᵒ | H.S |
| | Control | 30 | 5.4247 | 1.11261 | | |
| Creat | After | 83 | 497.0723 | 246.14116 | .000ᵒ | H.S |
| | Control | 30 | 74.3107 | 13.40813 | | |

Table (6) revealed that there was a significant (P-value<0.05) difference between sodium concentration (127.281±18.291) in ESRD patient after haemodialysis compared to control (133.377±10.049), whereas a highly significant (P-value<0.01) difference was observed between potassium concentration in the same patient (3.198±1.357) and control (4.183±0.762).

**Table 6: Change of sodium and potassium concentration in ESRD patient after H.D compared to control.**

| Parameter | | N | Mean | SD | Comparison of significant | |
|---|---|---|---|---|---|---|
| | | | | | P - value | Sig |
| Sod | After | 83 | 127.2810 | 18.29189 | .027 | S |
| | Control | 30 | 133.3770 | 10.04991 | | |
| Pot | After | 83 | 3.1981 | 1.35713 | .000ᵒ | H.S |
| | Control | 30 | 4.1830 | .76207 | | |

Table (7) revealed that there was a highly significant increase (P-value<0.01) between urea concentration in male ESRD patient before (24.929±7.730) and after (17.370±8.298) haemodialysis compared to control (5.447±1.016). On the other hand, a highly significant increase (P-value<0.01) was observed between creatinine concentration before (715.829±205.032) and after (544.104±272.768) haemodialysis in the same patient compared to control (77.576±12.977). These results were in agreement with the study of Andrzej J. Jaroszyński et al [12].

**Table 7: Urea and creatinine changes among male ESRD patient before and after HD compared with control.**

| Parameter | | N | Mean | S.D | ANOVA | |
|---|---|---|---|---|---|---|
| | | | | | P -value | sign |
| Urea | Before | 47 | 24.929 | 7.730 | .000* | HS |
| | Control | 20 | 5.447 | 1.016 | | |
| | After | 47 | 17.370 | 8.298 | | |
| Creat | Before | 47 | 715.829 | 205.032 | .000* | HS |
| | Control | 20 | 77.576 | 12.977 | | |
| | After | 47 | 544.104 | 272.768 | | |

Data illustrated in table (8) showed that there were no significant differences in the concentration of sodium before and after haemodialysis compared to control. These results were in agreement with the observation of HL Tang et al [13].

The table also showed that there were highly significant differences in the concentration of potassium before and after haemodialysis compared to control. These results were in agreement with the study of Reza Hekmat et al [14].

**Table 8: Electrolytes changes among male ESRD patient before and after HD compared with control.**

| Parameter | | N | Mean | S.D | ANOVA | |
|---|---|---|---|---|---|---|
| | | | | | P -value | sign |
| Sod | Before | 47 | 126.921 | 20.631 | .199 | NS |
| | Control | 20 | 135.992 | 10.209 | | |
| | After | 47 | 130.555 | 19.983 | | |
| Pot | Before | 47 | 4.291 | 1.693 | .006 | HS |
| | Control | 20 | 4.290 | .820 | | |
| | After | 47 | 3.395 | 1.358 | | |

Table (9) revealed that there was a significant increasing (P-value<0.01) between urea concentration in female ESRD patients before (23.243±7.243) and after (13.707±7.152) haemodialysis compared to control (5.380±1.343). On the other hand, a significant increasing (P-value<0.01) was observed between creatinine concentration before (655.805±200.362) and after (435.669±193.153) haemodialysis in the same patient compared to control (67.780±12.355). These results were in agreement with the observation of Luca **Gabutti** et al [15].

**Table 9: Urea and creatinine changes among female ESRD patient before and after HD compared with control.**

| Parameter | | N | Mean | S.D | ANOVA | |
|---|---|---|---|---|---|---|
| | | | | | P-value | sign |
| Urea | Before | 36 | 23.243 | 7.243 | .000* | HS |
| | Control | 10 | 5.380 | 1.343 | | |
| | After | 36 | 13.707 | 7.152 | | |
| Creat | Before | 36 | 655.805 | 200.362 | .000* | HS |
| | Control | 10 | 67.780 | 12.355 | | |
| | After | 36 | 435.669 | 193.153 | | |

Data illustrated in table (10) showed that there were no significant differences in the concentration of sodium before and after haemodialysis compared to control.

The table showed that there were highly significant differences in the concentration of potassium before and after haemodialysis compared to control, multiple comparison by LSD test revealed that the difference between before (4.114±1.788)and after (2.940±1.329)was a highly significant(P-value<0.01), while there was no significant difference(P-value>0.05) between before and control, after and control These results were in agreement with the result of Barry Kirschbaum et al [6].

**Table 10: Electrolytes changes among female ESRD patient before and after HD compared to control.**

| Parameter | | N | Mean | S.D | ANOVA | |
|---|---|---|---|---|---|---|
| | | | | | P -value | sign |
| Sod | Before | 36 | 125.5742 | 18.45395 | .618 | NS |
| | Control | 10 | 128.1460 | 7.73217 | | |
| | After | 36 | 123.0056 | 15.02780 | | |
| Pot | Before | 36 | 4.1142 | 1.78835 | .004 | HS |
| | Control | 10 | 3.9680 | .61186 | | |
| | After | 36 | 2.9406 | 1.32954 | | |

Data presented in table (11) shows that there was a highly significant difference (P-value<0.01) in the urea concentration before (23.036±6.594) and after (14.487±7.031) haemodialysis compared to control (5.228 ±1.048). Beside that the same table showed a highly significant difference (P-value<0.01) between

creatinine concentration before (700.676±6.594) and after (252.9445±14.4879) haemodialysis compared to control (74.758±13.763).

These results were in agreement with the result of Scott T. W. Morris et al [16].

**Table 11: Urea and creatinine changes according to age group (20-35) among ESRD patient before and after HD compared to control.**

| Parameter | | N | Mean | S.D | ANOVA | |
|---|---|---|---|---|---|---|
| | | | | | P -value | sign |
| Urea | Before | 34 | 23.0362 | 6.59461 | .000ᵒ | HS |
| | Control | 26 | 5.2281 | 1.04876 | | |
| | After | 34 | 14.4879 | 7.03103 | | |
| Creat | Before | 34 | 700.6765 | 213.33097 | .000ᵒ | HS |
| | Control | 26 | 74.7585 | 13.76398 | | |
| | After | 34 | 489.3529 | 252.94458 | | |

Data illustrated in table (12) showed that there were highly significant differences in the concentration of potassium before and after haemodialysis compared to control, multiple comparison by LSD test revealed that the difference between before (4.1209±1.56688) and after (2.8647±1.16368) ,and control(4.2185±.77324) was a highly significant(P-value<0.01), while there was no significant difference(P-value>0.05) between before and control.

The table showed that there were no significant differences (P-value>0.05) in the concentration of sodium before and after haemodialysis compared to control in this age group. These results were in agreement with the study of Andrzej J. Jaroszyński et al[12].

**Table 12: Electrolytes changes according to age group (20-35) among ESRD patient before and after HD compared to control.**

| Parameter | | N | Mean | S.D | ANOVA | |
|---|---|---|---|---|---|---|
| | | | | | P -value | sign |
| Sod | Before | 34 | 126.1629 | 21.06856 | .190 | NS |
| | Control | 26 | 133.7973 | 10.52860 | | |
| | After | 34 | 126.3603 | 18.51601 | | |
| Pot | Before | 34 | 4.1209 | 1.56688 | .000ᵒ | HS |
| | Control | 26 | 4.2185 | .77324 | | |
| | After | 34 | 2.8647 | 1.16368 | | |

Data presented in table (13) shows that there was a highly significant difference (P-value<0.01) in urea concentration before (27.1179± 9.12860) and after (18.3911±9.12962) haemodialysis compared to control (6.7025±.53711). The same table showed a highly significant difference (P-value<0.01) between creatinine

concentration before (791.9474±145.22874) and after (600.6842±242.07507) haemodialysis compared to control (71.4000±12.08691). These results were in agreement with the result of **Jan Górski** et al [17].

**Table 13: Urea and creatinine changes according to age (36-50) among ESRD patient before and after HD compared to control.**

| Parameter | | N | Mean | S.D | ANOVA | |
|---|---|---|---|---|---|---|
| | | | | | P -value | sign |
| Urea | Before | 19 | 27.1179 | 9.12860 | .000° | HS |
| | Control | 4 | 6.7025 | .53711 | | |
| | After | 19 | 18.3911 | 9.12962 | | |
| Creat | Before | 19 | 791.9474 | 145.22874 | .000° | HS |
| | Control | 4 | 71.4000 | 12.08691 | | |
| | After | 19 | 600.6842 | 242.07507 | | |

Result in table (14) represented the electrolytes changes according to age (36-50) among ESRD patient before and after HD compared to control. The data demonstrated in the table revealed that there was no significant difference (P-value>0.05) in the electrolytes concentration [sodium and potassium] compared to control.

**Table 14: Electrolytes changes according to age (36-50) among ESRD patient before and after HD compared to control.**

| Parameter | | N | Mean | S.D | ANOVA | |
|---|---|---|---|---|---|---|
| | | | | | P -value | sign |
| Sod | Before | 19 | 126.6142 | 14.94895 | .798 | NS |
| | Control | 4 | 130.6450 | 6.41062 | | |
| | After | 19 | 125.9742 | 10.74853 | | |
| Pot | Before | 19 | 4.0595 | 1.93261 | .243 | NS |
| | Control | 4 | 3.9525 | .74141 | | |
| | After | 19 | 3.1495 | 1.51961 | | |

Data presented in table (15) shows that there was a highly significant decrease (P-value<0.01) in urea concentration before (23.665± 7.171) and after (15.5957±8.12192) haemodialysis. In addition, there was a highly significant decrease (P-value<0.01) between creatinine concentration before (612.7667±199.17982) and after (440.2000±227.33825) haemodialysis. The above observations were in agreement with the result of Sadollah Shamsadini et al [18].

**Table 15: Urea and creatinine changes according to age (51-65) among ESRD patient before and after HD.**

| Parameter | | N | Mean | S.D | ANOVA | |
|---|---|---|---|---|---|---|
| | | | | | P -value | sign |
| Urea | Before | 30 | 23.6653 | 7.17147 | .000° | HS |
| | After | 30 | 15.5957 | 8.12192 | | |
| Creat | Before | 30 | 612.7667 | 199.17982 | .003 | HS |
| | After | 30 | 440.2000 | 227.33825 | | |

Result in table (16) represented the electrolytes changes according to age (51-65) among ESRD patient before and after HD. The data demonstrated in the table revealed that there was no significant difference (P-value>0.05) in the electrolytes concentration [sodium and potassium] compared to control. The above observations were in agreement with the result of Nauman Tarif, et al [19].

**Table 16: Electrolytes changes according to age (51-65) among ESRD patient before and after HD.**

| Parameter | | N | Mean | S.D | ANOVA | |
|---|---|---|---|---|---|---|
| | | | | | P -value | sign |
| Sod | Before | 30 | 126.3583 | 21.06091 | .616 | NS |
| | After | 30 | 129.1520 | 21.87504 | | |
| | Control | | | | | |
| Pot | Before | 30 | 4.4190 | 1.80295 | .055 | NS |
| | After | 30 | 3.6067 | 1.38891 | | |
| | Control | | | | | |

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