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Serum Adropin Levels in Relation to Nutritional Status in Hemodialysis Patients

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Abstract

Hemodialysis (HD) is an alternate of renal functioning in patients with end stage renal disease (ESRD). Malnutrition is a common problem in patients with end stage renal disease (ESRD) undergoing hemodialysis (HD) that is associated with increased morbidity and mortality. Adropin is a novel pleotropic peptide involved in energy hemostasis, with possible contribution to cardiovascular protection through production of nitric oxide and subsequent blood pressure regulation. To determine the relationship between serum adropin levels and nutritional status and other relevant clinical and laboratory parameters in hemodialysis patients. The current work is a Case control study. A total number of 60 Egyptian patients (20 mild malnourished, 20 moderate malnourished, 20 severe malnourished) with chronic kidney disease patients on regular hemodialysis, they were selected from patients attending the dialysis unit at Al-Zaharaa University Hospital during the period from August 2021 to January 2022 and 20 apparently healthy volunteers. Adropin level was significantly lower in hemodialysis patients (especially in severe HD being 180.42±93.068) compared to control group (403.35±108.021) with p-value <0.001. statistically significant negative correlation between dialysis malnutrition score (DMS) and Adropin level with p-value=0.001. Adropin may be a reliable marker that can help in prediction of malnutrition among hemodialysis patients.

Keywords: Adropin, Hemodialysis, Lipid profile, Malnutrition.

1. Introduction

Chronic kidney disease (CKD) is defined as the presence of kidney damage or an estimated glomerular filtration rate (e GFR) less than 60 ml/min/1.73 mt2, persisting for 3 months or more, irrespective of the cause. It is a state of progressive loss of kidney function ultimately resulting in the need for renal replacement therapy (dialysis or transplantation) [1]. Hemodialysis (HD) is an artificial procedure of removing excess fluids, minerals, and toxins from the blood of patients who have an impaired renal function. HD is one of the most used renal replacement therapies and a life-depending method for patients with chronic kidney disease (CKD), the procedure is associated

with a high cardiovascular risk, morbidity, mortality and malnutrition [2].
Malnutrition is a common problem in patients with end stage renal disease (ESRD) undergoing hemodialysis (HD) that is associated with increased morbidity and mortality. The pathogenesis of malnutrition in patient with HD is multifactorial. Inadequate food intake due to anorexia and endocrine disorders of uremia were reported as major causes of malnutrition in maintenance hemodialysis (MHD). It is advocated that early detection of malnutrition will facilitate early and comprehensive nutritional support, effective management and prevention of the associated negative clinical outcomes for malnutrition. Various methods have been used to evaluate the nutritional state of HD patients. Among these methods, subjective global assessment (SGA) [3].
Since CKD/HD are associated with malnutrition so we need something more accurate and easier to determine the level of malnutrition for dialysis patients, such as adrobin. Adropin is a novel pleotropic peptide which is encoded by the ENHO gene whose expression was found in the liver and brain, but its presence was also established in the muscle, heart, pancreas, and kidneys [4].
However, studies have showed that adropin has a wide range of diverse effects, among which the most prominent one is maintaining energy homeostasis through glucose and lipid metabolism regulation [5].

2 .Patients and Methods

This study is a case control study. A total number of 60 Egyptian patients with chronic renal failure, they were 33 males (55%) and 27 females (45%) and their ages ranged between (23-75) years with mean (55.943 ± 13.157 years) (20 mild malnourished, 20 moderate malnourished, 20 severe malnourished) according to dialysis malnutrition score (Table. 1) (group I), they were selected from patients on hemodialysis at Al-Zaharaa University Hospital during the period from August 2021 to January 2022 and 20 apparently healthy volunteers were included in the study as a control group They were 7 males (35%) and 13 females (65%) and their ages ranged from (24 - 75) years with mean (51.45 ± 13.778) years (group II).

2.1. Ethical Consideration

Approved by ethical committee at faculty of medicine for girls – Cairo, Al-Azhar University. A written consent was obtained from all patients before getting them involved in the study.
The patient and control groups had the right to withdraw from the study at any time without giving any reasons.

2.2. Exclusive criteria

- Stroke
- Myocardial infarction
- Uncontrolled hypertension
- Alcoholism
- Autoimmune diseases
- Malignancies
- Liver diseases
- Hypoglycemia episode
- Smoking
- Patient receiving corticosteroid therapy.

2.3 .All patients and control groups were subjected to the following

1 .Full medical history
2 .Complete clinical Examination
3 .Pelvic and abdominal Ultrasonography will be done for all subjects
4 .Anthropometric Measurements: Body weight (kg), body height (cm), body mass index (kg/m2), waist circumference (cm), hip circumference (cm), Skinfold thickness, body fat percentage (%), dry

body weight (kg) and interdialytic weight gain IDWG (kg) **.**
5 **.**Biochemical measurements **:**
1**.**Serum Adropin Levels were measured using enzyme –linked immune – sorbent assay (ELISA) **.**
2**.**complete blood count (CBC) (g/L)**.**
3**.**Fasting blood glucose (mg/dL)**.**
4**.**Pre & Post-dialysis blood urea (mg/dL) **.**
5**.**pre & Post serum creatinine (mg/dL) **.**
6**.**Total bilirubin (mg/dL) **.**
7**.**Total blood proteins (g/L) **.**
8**.**Serum Albumins (g/L) **.**
9**.**Lipid profile (Total cholesterol (mg/dL **,(** Triglycerides (mg/dL), HDL (mg/dL) & LDL (mg/dL) **.**
10.C-reactive protein (mg/L).

2.4 .Statistical analysis

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp) [6], [7]. Qualitative data were described using number and percent. The Kolmogorov-Smirnov test was used to verify the normality of distribution Quantitative data were described using range (minimum and maximum), mean and standard deviation. Significance of the obtained results was judged at the 5% level.

1- Chi-square test

For categorical variables, to compare between different groups**.**

2 –ANOVA test

For normally quantitative variables, to compare between two studied groups**.**

3 –Kruskal-Wallis H test

For abnormally quantitative variables, to compare between two studied groups.

4– Probability (P-value)

- P-value < 0.05 was considered significant.
- P-value < 0.001 was considered as highly significant.
- P-value > 0.05 was considered no significant.
- P: Comparison between control group and hemodialysis group.
- P1: Comparison between control group and other groups (mild, moderate and severe).
- P_2: Comparison between groups (mild and moderate), (Mild and severe).
- P_3: Comparison between moderate group and severe group.

3. Result

Table. 1 shows significant decreased BMI, Waist circumference and Hip circumference in hemodialysis group especially severe group with p value (0.005, 0.011and 0.007) compared to control. Table. 2 shows significant decreased Body fat percentage in hemodialysis group especially severe group with p value (0.016) compared to control. Table. 3 shows highly significant elevated Duration of Hemodialysis and Dialysis Malnutrition Score between hemodialysis groups with p value (< 0.001). Table .4 shows highly significant elevated Total Bilirubin in hemodialysis groups especially in severe group compared to control with p value (< 0.001), highly significant decreased Total Blood proteins in hemodialysis groups especially in severe group compared to control with p value (< 0.001) and highly significant decreased Serum Albumin in hemodialysis groups especially in severe group compared to control with p value (< 0.001). Table. 5 shows highly significant elevated Total Cholesterol in hemodialysis groups especially in severe group compared to control with p value (< 0.001), significant elevated.

Table (1): Comparison between groups as regard to patient's measurements and body fat percentage.

	Control Group (n=20)	Hemodialysis Group			P Value
		Mild Group (n=20)	Moderate Group (n=20)	Severe Group (n=20)	
Body mass index					
Mean± S. D	28.07±3.145	30.19±6.115	29.15±3.699	25.29±3.808	0.005*
P_1		0.128	0.434	0.046*	
P_2			0.453	0.001*	
P_3				0.006*	
Waist circumference					
Mean± S. D	91.70±16.187	98.65±23.159	95.45±17.566	78.15±16.759	0.011*
P_1		0.242	0.526	0.024*	
P_2			0.552	0.015*	
P_3				0.019*	
Hip circumference					
Mean± S. D	105.70±13.872	110.05±17.410	107.95±12.984	93.85±13.724	0.007*
P_1		0.349	0.627	0.012*	
P_2			0.613	<0.001*	
P_3				0.002*	

Table (2): Comparison between groups as regard to patient's Body fat percentage.

Body fat percentage	Control Group (n=20)	Hemodialysis			P Value
		Mild Group (n=20)	Moderate Group (n=20)	Severe Group (n=20)	
Mean± S. D	35.95±7.104	36.50±10.635	35.70±9.004	29.65±8.190	
P_1		0.296	0.191	0.001*	0.016*
P_2			0.790	0.025*	
P_3				0.047*	

Table (3): Comparison between groups as regard to patient's Duration of Hemodialysis and DMS.

Duration of CKD	Hemodialysis		
	Mild Group (n=20)	Moderate Group (n=20)	Severe Group (n=20)
Mean± S. D	1.40±0.503	3.40±1.046	7.00±2.176
P_1		<0.001*	<0.001*
P_2			<0.001*
Dialysis Malnutrition Score			
Mean± S. D	10.20±1.322	17.15±2.231	26.45±5.236
P_1		<0.001*	<0.001*
P_2			<0.001*

Table (4): Comparison between groups as regard to patient's liver function.

	Control Group (n=20)	Hemodialysis			P Value
		Mild Group (n=20)	Moderate Group (n=20)	Severe Group (n=20)	
Total Bilirubin					
Mean± S. D	0.65±0.305	0.84±0.223	1.08±0.311	1.18±0.255	<0.001*
P_1		0.033*	<0.001*	<0.001*	
P_2			0.007*	<0.001*	
P_3				0.280	
Total Blood proteins					
Mean± S. D	7.21±0.711	6.71±0.477	6.43±0.515	5.58±0.577	<0.001*
P_1		0.007*	<0.001*	<0.001*	
P_2			0.129	<0.001*	
P_3				<0.001*	
Serum Albumins					
Mean± S. D	4.81±0.629	3.99±0.483	3.70±0.393	3.07±0.377	<0.001*
P_1		<0.001*	<0.001*	<0.001*	
P_2			0.065	<0.001*	
P_3				<0.001*	

Table (5): Comparison between groups as regard to patient's lipid profile.

	Control Group (n=20)	Hemodialysis			P Value
		Mild Group (n=20)	Moderate Group (n=20)	Severe Group (n=20)	
Total Cholesterol					
Mean± S. D	88.10±29.234	141.35±38.894	157.55±42.676	192.95±28.520	<0.001*
P_1		<0.001*	<0.001*	<0.001*	
P_2			0.152	<0.001*	
P_3				0.002*	
Triglycerides					
Mean± S. D	96.05±21.125	108.20±36.007	117.20±43.405	136.70±36.857	0.007*
P_1		0.280	0.062	<0.001*	
P_2			0.423	0.013*	
P_3				0.085	
HDL					
Mean± S. D	61.80±23.334	59.70±17.336	48.65±15.500	25.65±9.593	<0.001*
P_1		0.700	0.018*	<0.001*	
P_2			0.045*	<0.001*	
P_3				<0.001*	
LDL					
Mean± S. D	48.05±12.284	100.00±21.815	98.65±25.336	110.00±36.951	<0.001*
P_1		<0.001*	<0.001*	<0.001*	
P_2			0.868	0.222	
P_3				0.166	

Table (6): Comparison between groups as regard to patient's lipid profile.

Adropin	Control Group (n=20)	Hemodialysis			P Value
		Mild Group (n=20)	Moderate Group (n=20)	Severe Group (n=20)	
Mean± S. D	403.35±108.021	229.93±156.521	200.58±128.156	150.42±93.068	
P_1		<0.001*	<0.001*	<0.001*	<0.001*
P_2			0.021*	0.001*	
P_3				0.008*	

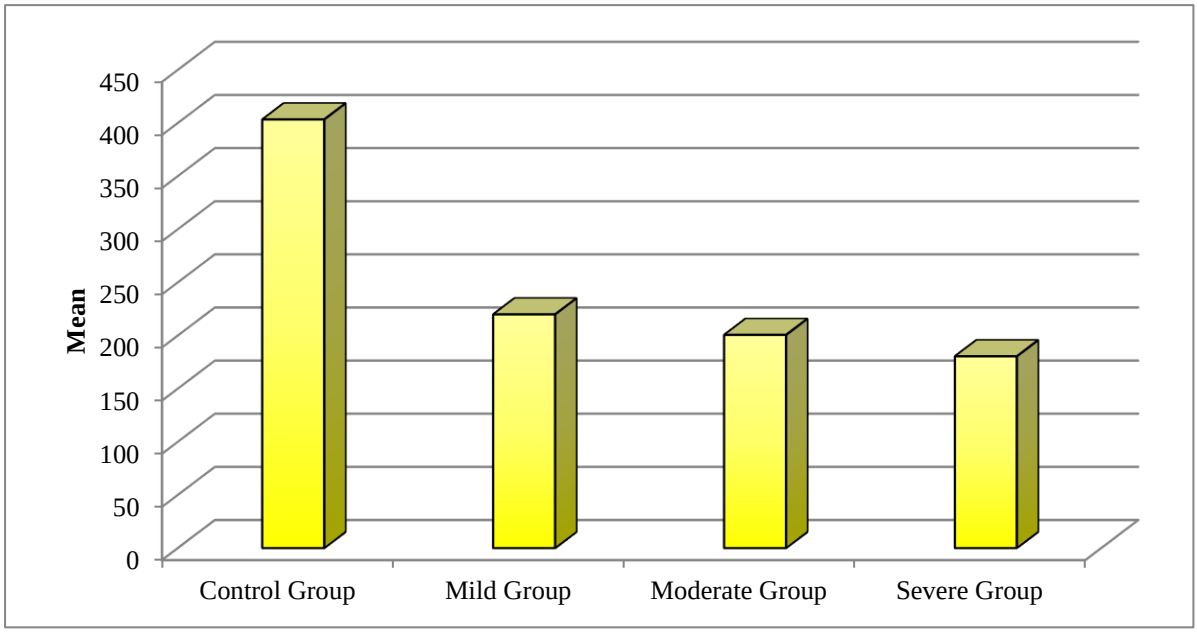

Figure (1): Comparison between groups as regard to patient's Adropin.

Table (7): Correlation between Adropin and different parameter.

	Adropin	
	R	**P**
Age	-0.286	0.010*
BMI	-0.583	<0.001*
Waist circumference	-0.595	<0.001*
Hip circumference	-0.562	<0.001*
Body fat percentage	-0.386	<0.001*
Duration of CKD	-0.336	0.009*
Dialysis Malnutrition Score	-0.414	0.001*
Total Billirubin	-0.299	0.007*
Total blood proteins	0.322	0.004*
Serum albumins	0.390	<0.001*
LDL	-0.494	<0.001*
Total cholesterol	-0.490	<0.001*
Triglycerides	-0.490	<0.001*
HDL	0.275	0.014*
CRP	-0.615	<0.001*

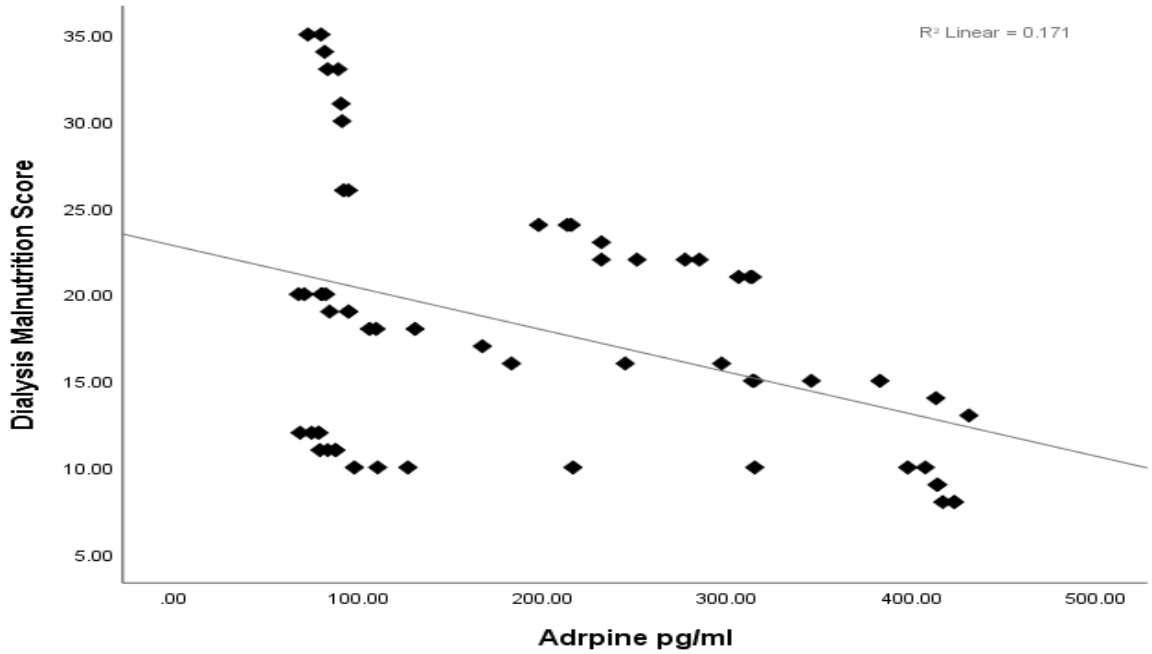

Figure (2): Negative Correlation between Adropin and Dialysis Malnutrition Score.

Triglycerides in hemodialysis groups especially in severe group compared to control with p value (0.007), highly significant decreased HDL in hemodialysis groups especially in severe group compared to control with p value (< 0.001) and highly significant elevated LDL in hemodialysis groups especially in severe group compared to control with p value (< 0.001).

Correlation between Adropin and different parameter gave:

Negative highly statistically significant correlation between Adropin and each of age (r=-0.286 and P=0.010), BMI (r=-0.583 and P<0.001),waist circumference (r=-0.595 and P<0.001), hip circumference (r=-0.562 and P<0.001), Body fat percentage (r=-0.386 and P<0.001), LDL (r=-0.494 and P<0.001), Total cholesterol (r=-0.490 and P<0.001), triglycerides (r=-0.490 and P<0.001) and CRP (r=-0.615 and P<0.001). Also, with duration of HD (r=-0.336 and P=0.009). Dialysis Malnutrition Score (r=-0.414 and P=0.001), Figure 2 while there was positive highly statistically significant correlation between Adropin and each of HDL (r=0.275 and P=0.014), Albumine (r=0.390 and P=0.001) and total blood proteins (r=0.322 and P=0.004). Table. 7.

4. Discussion

Plantar The current study revealed that BMI was statistically significant decreased in severe and moderate hemodialysis groups compared to mild hemodialysis and control group. In agreement with Kamal et al 2019 [10]. Similarly, Tan et al 2016 [11].

The current study revealed that severe and moderate malnutrition were significantly associated with longer duration of HD compared to mild malnutrition group. The same was reported by Bramania et al 2021 [12].

The current study revealed that dialysis malnutrition score was statistically significant higher in severe and moderate hemodialysis groups compared to mild hemodialysis group.in agreement with Boric-Skaro et al 2021 [4].

The current study found statistically significant higher CRP level in severe malnourished HD patients compared to mild and moderate malnutrition groups and control group. This goes in run with Boaz et al 2019 [13].

In the current study, adropin level was significantly lower in hemodialysis patients (especially in severe HD) compared to control group. The same was reported by Boric-Skaro et al 2021 [4].

The current study found statistically significant negative correlation between dialysis malnutrition score (DMS) and Adropin level This goes in run with Boric Skaro et al 2021 [4]. As regards lipid profile, our study found a statistically significant negative correlation between Adropin, LDL, cholesterol, and TG while there was statistically positive correlation between Adropin level and HDL level. Similarly, another study by Zang et al 2018. [14].

The current study found statistically significant positive correlation between adropin level and albumin. The same was reported by Es-haghi et al 2021 [15].

The current study revealed a statistically negative correlation between Adropin level and CRP. Another study by Choi et al 2018. [16].

5. Conclusion

Adropin may a reliable marker that can help in prediction of malnutrition among hemodialysis patients which significantly correlated with other malnutritional parameters including weight, fat, body mass index, many inflammatory markers as CRP, renal functions, lipid profile, and dialysis nutritional score.

Recommendations:

1- Further longitudinal studies with large sample size are needed for further evaluation of Adropin level in hemodialysis patients and its role in prediction of malnutrition.

2- Adropin needed to be further evaluated in outcome of malnutrition including frequency of hospitalization and mortality.

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