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# Low Concentration of Vitamin [D, E] and Total Antioxidant Status [TAS] in Blood Serum in Acute Kidney Injury Patients


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**Abstract:**

Acute Kidney injury is usually diagnosed by measuring several biochemical variables, A decrease in vitamin (D, E) and total antioxidant status (TAS) is often associated with occurs as a result of an imbalance between oxidants and antioxidants, Vitamin (D, E) and (TAS) represent Powerful antioxidants for predicting acute kidney injury. Here, our Study aimed to estimate Vitamin (D, E) and (TAS) in acute kidney injury patients compared to the control group, and try to prove their Low Concentrations as indications of acute kidney injury.



**Keywords:** Acute Kidney Injury, vitamin D, Vitamin E, Total antioxidant status (TAS).

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## Introduction

Acute kidney Injuries are Called Acute Kidney Failure, which occurs when the kidneys stop functioning suddenly, within a few hours or days, which leads to losing the ability to rid the body of toxic waste and its accumulation inside the body, which leads to the Kidney Losing its ability to maintion balance [1].

## Material and methods

In this study, (232) blood samples were Collected, distributed between 108 blood Samples, which represent the control group, and 124 blood Samples, which represent acute Kidney injury patients, during a period of time that extended (May 2022-Fabraury 2023), and the ages of the participants ranged between (≤ 35-≥ 56 years), the Samples were Collected from (Al-Salam, Ibn Sina and Al-Jumhuri) teaching Hospitals and the Central Blood Bank, in the city of Mosul, Iraq, where blood Samples were collected using gel tubes, then the level of Vitamin (D, E) and (TAS) was measured and the results indicated that there was a significant decrease in the Level of vitamin (D, E) and (TAS) at a Significant Level of ($P \leq 0.05$) in the blood Serum of acute kidney injury.

**Vitamins:** They are basic and complex organic compounds found in small quantities in the body that stimulate metabolic reactions in the body, they can be obtained from food and supplements, severe vitamin deficiency Leads to disease [2]. Excessive amounts can be of these vitamins are harmful to people with amounts Kidney failure, because it can accumulate in the body and become toxic, vitamins are divided into two main groups: the water-soluble vitamins (vitamin C & B Complex), and the fat-soluble vitamins (A, D, E and K). Dialysis patients may need to add Vitamin C to the patients to replace what was lost from the dialysis Solution [3]. This is because Vitamins are essential for metabolism and building protein for growth.

**Vitamin D:** which is known as calciferol is a Vitamin from the group of fat-soluble vitamins, it is found in a Specific number of foods naturally in addition to other foods, and it is also found as a nutritional supplement, it is also produced endogenously when UV rays hit the Skin and Stimulate the formation of Vitamin D, this enhances the absorption of calcium in the gut and maintains an appropriate Concentration of calcium and phosphate in the serum to enable normal bone mineralization and with frequent Calcium deficiency (involuntary Contraction of muscles, leading to Cramps) [5][4]. In addition, vitamin D. regulates many one of the other functions in the cells of the body, its anti-inflammatory, oxidative and neuroprotective properties support the health of the immune system, muscle functions, and brain cell activity. The amount of Vitamin D produced by the Skin depends on many factors, including the time of day, season, place in which we live, and lifestyle [6, 7]. It was found that vitamin D disorders not only cause (Kidney insufficiency or toxicity), but also can lead to AKI. In addition, acute kidney injury can Lead to significant disturbances in the metabolism of Vitamin D. Moreover, it has been found that Vitamin D is used a new biomarker to Predict the risk of AKI. Finally, animal results showed that vitamin D can improve AKI and thus Prevent its occurrence, acting as a novel Prognostic agent in the treatment of acute kidney injury [8].

**Vitamin E:** It is one of the antioxidants that are naturally present in Various foods such as green Leafy vegetables, nuts and Seeds. It is one of the group of fat-soluble Vitamins and is important for many processes in the body, This vitamin is used to treat or prevent vitamin E deficiency [9]. kidney disease (KD) is Characterized by the Presence of high oxidative stress, which in turn Contributes to the high rate of Cardiovascular mortality in these people, the fat-soluble Vitamins (Vitamin E) are powerful dietary antioxidants and have anti-inflammatory functions [10]. Building on the benefits associated with Vitamin E such as its Powerful antioxidant function, low toxicity, rare side effects, and Low Cost, this treatment Strategy has gained great interest in the scientific community to develop new treatment methods against Acute Kidney Injury (AKI) [11].

**Total antioxidants Status:-** are used to measure the overall antioxidant status in the body, Where the Oxidative Stress Index (OSI) is the ratio of Total oxidant status (TOS) to Total antioxidant Status (TAS), where most of the causes of acute kidney insufficiency are associated with ischemia and acute hypoxia from the general or regional decrease in Kidney blood flow, where ischemia works to severally reduce cellular oxygenation and nutrient absorption, and thus Leads to acute tubular necrosis and inflammation, and this in turn can Lead to an exacerbation of the infection, kidney failure and cause functional changes in the kidney [12]. Ischemia and re-perfusion are known factors for tissue damage by reactive oxygen species [13]. Although ROS (Reactive Oxygen Species) Perform physiological functions, the accumulation of Ros above or unregulated it can Cause oxidative damage to biomolecules, and disturbances in membrane and organelle factions. Detoxification or degradation processes faclited by endogenous antioxidants often balance redox production [14].

**Groups participating in the Study:**
The total number of participants in this study was (232) Participants, who were divided into two groups for the study: The first group is the Control group and its number was (108) Participants, in which the number of males and Females in a ratio of 1:1, which is (54:54) while the Second group was the group of patients with acute kidney injuries, which numbered (124) Participants, where the ratio of males was equal to females 1:1, which is (62:62), their ages ranged between (≤ 35-≥56 years), during a Period of time between (May 2022- February 2023)From (Ib Sina, Al-Salam, and Al Jumhuvi) Teaching Hospitals and the Central Blood Bank in the City of Mosul, Iraq.

**Volume of the collected blood sample:**
Gel tubes were used to collect 10 ml of blood, from both acute kidney injury patients as well as the control group, and then kept temperature of 4 $C^{O}$ for 15 minutes, then centrifuged at (3500ypm) for 15 minutes, after which the serum was separated into Sterile and Clean tubes and kept at a temperature of -20$C^{O}$ until use.

**Estimation of Study Parameters:**
In this study, we estimated the level of vitamin (D, E) and (TAS) in the Serum of both acute kidney injury patients and the control group.

* **Vitamin D:** The level of vitamin D was estimated using the Cobase e 411 anylazer equipped by the German Company Roche [15].
* **Vitamin E:** The level of Vitamin E was determined by using a colorimetric assy kit (colorimetric method), using a Spectrophoto meter at two wavelengths (533 nm) Calalog No: E-BC-K033-5) [16].

**Total antioxidant status (TAS):** The level of (TAS) was determined by using a colorimetric assy Kit (Colorimetric method), Using microplate reader at (660nm). Calalog No: E-BC-K801-M [17].

**Statistical analysis:**
The SPSS Statistical analysis system was used to analyze the results of the Study Statistically, in this study, as it was study through the (independent T test) analysis program to analyze the results of study that include two Variables, while the Completely Randumized Design (CRD) was used to analyze the variance of traits that included more than two variables, and that through one way analysis of Variance, as well as extracting the Correlation Coefficient for some of the School characteristics, and the correlation factors as well as extracting the (means), as well as extracting the standard errors while using Duncan's Multiple Range Test, in order to find the difference between means significant reduction Score P ≤0.05 [18].

**Results and discussion**
The results obtained from measuring the level of biochemical variables in the serum of patients with acute kidney injury injuries were discussed and compared with the control group: The results showed in table (1) that there was a Significant decrease in the level of Vitamin D at the level of p≤0.05 in the blood serum of Patients with acute kidney injuries (7•163 ± 0.387) pg/ml. Compared to the Control group (21.166±0.697)pg/ml. The reason for this decrease is due to the existence of a bidirectional relationship between Vit D and AKI, as kidney injury can lead through different mechanisms, either deficiency in vit D or more. In addition, it is possible that both this deficiency in vit D or the toxicity resulting from its increase in the development of AKI and this is indicated by the authors (Graidis S et al; 2020) [19]. The gradual decrease in kidney function during kidney insufficiency leads to acute phosphate retention and accumulation, due to the inability of the kidney to excrete it, as phosphate acts as a negative regulator of 1-hydroxylase, to build the enzyme 1,2 (OH)2 D and thus negatively affects vit D metabolism [20].
Table (1) also shows that there is a significant decrease in the Level of vitamin E in acute kidney injury patients (3.990±0.201) Mg/ml at a significant level of P≤0.05. Compared to the control group (22.194 ± 0.450) Mg/ml. The reason is that vitamin E is a powerful antioxidant, and in the Case of AKI we notice a decrease in antioxidant activity and the direct cytotoxic effect of reactive oxygen species as a result of Kidney damage and this in turn leads to a decrease in vitamin E Level in Patients with acute kidney injury [21].

we also notice from Table (1) and from the data Shown that there is a significant decrease in the level of TAS (0.639 ± 0.026) mmol Trolox Equiv. /L. This case can be explained as kidney failure is a disease, it affects the Kidney Functions, due to inhibition of the glomerular filtration rate, Thus oxidative stress develops and increases with the development of infection during cases of kidney failure [22].

**Table 1** Level of biochemical parameters measured in the blood serum patients with acute kidney injury compared to control group.

| Biochemical parameters | Coontrol group N=108 | | Patients group N=124 | | P-Value |
|---|---|---|---|---|---|
| | Mean | ±SE | mean | ±SE | |
| Vitamin D (pg/ml) | 21.166* | 0.697 | 7.163 | 0.387 | P≤ 0.05 |
| Vitamin E (Mg/ml) | 22.194* | 0.450 | 3.990 | 0.201 | P≤ 0.05 |
| TAS mmol trolox Equiv./L | 1.206* | 0.024 | 0.639 | 0.026 | P≤ 0.05 |

*Itindicates a significant difference horizontally at a significant level P≤0.05

Correlation between biochemical Variables measured in the blood serum of acute Kidney patients and Compared with the Control groups. This relationship Can be clarified through Table 2, which is studied by finding the linear Correlation Coefficient (r).

**Table 2** Correlation between biochemical variables measured in the blood serum of acute kidney patients and compared with the control group.

| Biochemical parameters | Control group N=108 | Patients group N=124 |
|---|---|---|
| | V-Value | P-Value |
| Vitamin D (pg/ml) | 0.599** | P≤0.05 |
| Vitamin E (Mg/ml) | 0.351** | P≤0.05 |
| TAS (mmol Trolox equiv./L) | 0.269** | P≤0.05 |

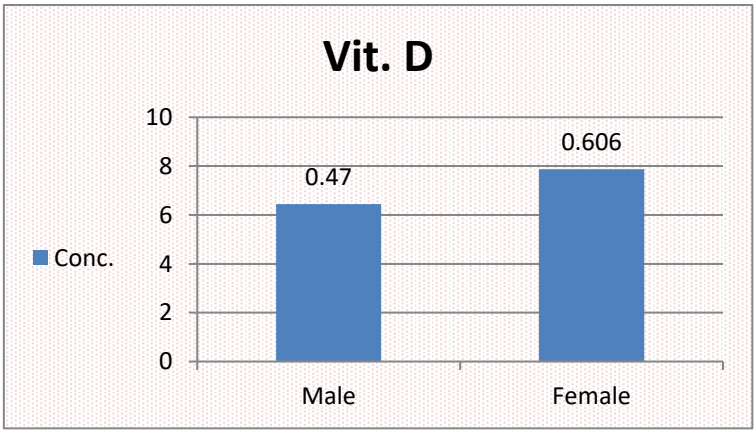
**Significant differences in the correlation coefficient between each two variables horizontally at a significant level P≤0.05.

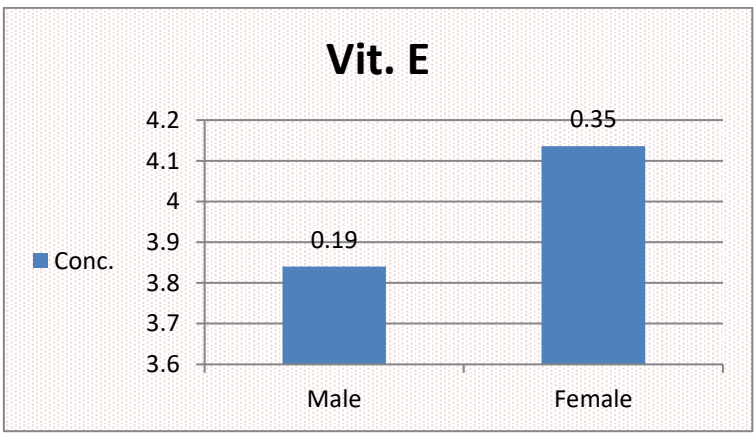
Table (2) There are significant differences in the Correlation coefficient between each of the two horizontal averages for each of the acute Kidney Patients and the Control group, where we note that the level of Vitamin D in patients with acute kidney injuries is low Compared to the control group, as the active and local vitamin D Serum Levels decrease in patients with severe diseases and are associated with acute kidney injury (AKI). In addition to dysregulation of calcium and phosphate homeostasis [23], acute kidney injury is a major depletion of kidney function, affecting normal Kidney enzymatic activity, and thus inactivating vitamin D. Normally, a decline in Kidney function Leads to vitamin D deficiency [19].
The table (2) also shows us that there is a significant decrease in the level of Vit E, which acts as an antioxidant in the detoxification Chain of soluble fats in water-soluble toxic radicals. It works to Protect different tissues in lipid proxidation, in the case of acute kidney injury, there is a decrease in antioxidant activity [21] [24].
Likewise, the decrease in the level of TAS, in the Case of acute Kidney injury, due to the decrease in Kidney functions and the ability of the Kidney to rid the body of toxins [22].

**The effect of sex on the level of biochemical measured in the blood serum of Patients with acute kidney injury:**
Table (3) and Figure (1), show that there are significant difference at a P≤0.05, and here we notice that there are no significant differences between males and females in the Level of vit (D, E) and TAS at a Significant level of P≤0.05.
**Table 3** The effect of sex on the level of biochemical parameters measured in the blood serum of patients with acute kidney injury.

| Biochemical parameters | Males N=62 | | Females N=62 | | P-Value |
|---|---|---|---|---|---|
| | mean | ±SE | mean | ±SE | |
| Vitamin D (pg/ml) | 6.452 | 0.469 | 7.874 | 0.606 | 0.066 |
| Vitamin E (Mg/ml) | 3.841 | 0.195 | 4.137 | 0.351 | 0.463 |
| TAS (mmol Trolox equiv./L) | 0.616 | 0.036 | 0.663 | 0.039 | 0.375 |

Significant difference at a significant level p≤0.05.



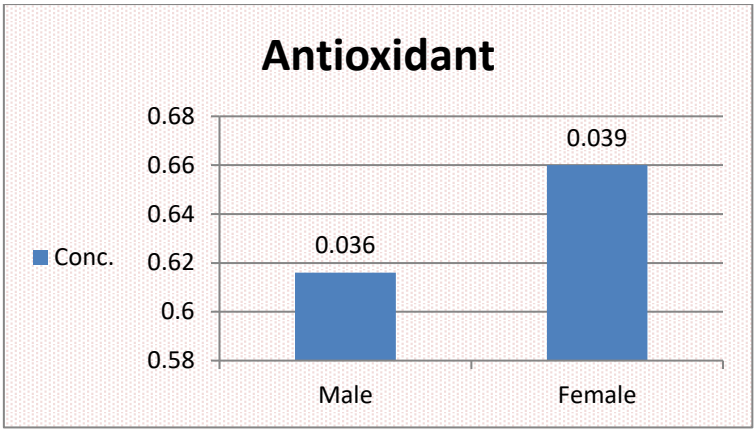



**Figure 1**. The effect of sex on the level of biochemical parameters measured in the blood serum of patients with acute kidney injury.

**Conclusion**

We conclude, through this study, that there was a decrease in the concentration of vitamin (D, E) and TAS in acute kidney injury patients, as a result of a decrease in Kidney function with acute injury, an increase in oxidative stress, and a decrease in antioxidants vitamin (D, E) and TAS.

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