

# THE EVALUATION OF OXIDATIVE STATUS VIA THE MEASUREMENTS OF TOTAL OXIDANT STATUS, TOTAL ANTI-OXIDANT STATUS, ISCHEMIA-MODIFIED ALBUMIN AND OXIDIZED-LOW DENSITY LIPOPROTEIN IN PATIENTS WITH VITAMIN D DEFICIENCY

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## Introduction

➤ Oxidative damage may be responsible for pathogenesis and complications of many diseases. Vitamin D deficiency has been suggested as a potential mediator of various extra-skeletal pathologies. However, there are limited data on anti-oxidant properties of vitamin D.

## Methods

➤ Forty-one subjects with vitamin D deficiency and 30 healthy controls were enrolled in the study. The levels of total anti-oxidant status (TAS), total oxidant status (TOS), ischemia-modified albumin (IMA), oxidized-low density lipoprotein (ox-LDL), high-sensitivity C-reactive protein (hs-CRP) and fibrinogen were measured in the patient and control groups.

## Results

➤ IMA and TOS levels in patients were significantly higher than those of controls ( $p < 0.001$  and  $p = 0.035$ , respectively). TAS levels were significantly lower in patients, compared to controls ( $p < 0.001$ ). In addition, fibrinogen was significantly higher in patients than controls ( $p = 0.003$ ) while ox-LDL and hs-CRP levels were similar between the two groups ( $p > 0.05$  for all parameters) (Table 1).

➤ In 17 patients whose oxidative stress parameters were measured again after the replacement of vitamin D, it was observed that TAS level was significantly increased ( $p = 0.037$ ), and the levels of TOS and fibrinogen were significantly decreased ( $p = 0.043$  and  $p = 0.010$ , respectively). No alterations were seen in IMA, ox-LDL and hs-CRP levels after the replacement ( $p > 0.05$  for all parameters) (Table 2).

➤ A negative correlation was observed between vitamin D levels, and IMA and fibrinogen levels ( $r = -0.500$ ,  $p < 0.001$  and  $r = -0.391$ ,  $p = 0.002$ , respectively). In addition, vitamin D was positively correlated with TAS levels ( $r = 0.430$ ,  $p < 0.001$ ). No significant correlation was found between vitamin D levels, and TOS, ox-LDL and hs-CRP levels ( $p > 0.05$  for all parameters).

➤ Serum calcium (Ca) levels were negatively correlated with IMA levels ( $r = -0.406$ ,  $p = 0.001$ ), and no significant correlation was found between serum Ca, and TAS, TOS and ox-LDL ( $p > 0.05$  for all parameters). In addition, serum phosphorus (P) levels were not correlated with IMA, TAS, TOS and ox-LDL levels ( $p > 0.05$  for all parameters).

**Table 1. Laboratory data of the study groups**

	Patients (n=41)	Controls (n=30)	p
Age (yrs)	40.2±9.4	41.29±8.6	0.666
Female/Male	33/8	24/6	0.959
25(OH)D (ng/mL)	10.72±5.31	32.09±3.61	<0.001
Serum Ca (mg/dL)	9.11±0.37	9.11±0.26	0.915
Serum P (mg/dL)	3.41±0.38	3.30±0.36	0.227
TAS (mmol Trolox equiv./L)	1.28±0.11	1.42±0.15	<0.001
TOS (µmol H <sub>2</sub> O <sub>2</sub> equiv./L)	4.98±4.00	3.48±1.43	0.035
IMA (ABSU)	0.54±0.10	0.38±0.16	<0.001
Ox-LDL (ng/L)	1451.30 (703-6776.30)	1618 (669.70-3823.0)	0.895
Hs-CRP (mg/L)	1.14 (0.16-11.70)	1.26 (0.27-9.85)	0.780
Fibrinogen (g/L)	392.99±69.06	329.93±97.74	0.003

**Table 2. Pre- and post-treatment oxidative stress parameters of patients with vitamin D deficiency**

	Before (n=17)	After (n=17)	p
25 (OH) D (ng/mL)	8.33±1.47	41.75±14.28	<0.001
Serum Ca (mg/dL)	9.13±0.37	9.25±0.28	0.286
Serum P (mg/dL)	3.41±0.40	3.47±0.35	0.594
TAS (mmol Trolox equiv./L)	1.25±0.09	1.30±0.07	0.037
TOS (µmol H <sub>2</sub> O <sub>2</sub> equiv./L)	5.12±4.70	2.78±1.17	0.043
IMA (ABSU)	0.54±0.10	0.47±0.13	0.098
Ox-LDL (ng/L)	1391.35 (1059.7-6776.3)	1179.65 (736.3-6076.3)	0.394
Hs-CRP (mg/L)	0.94 (0.16-11.70)	0.96 (0.15-6.24)	0.112
Fibrinogen (g/L)	390.41±63.04	334.90±89.58	0.010

## Conclusion

➤ In this study, increased levels of TOS and IMA were observed in patients with vitamin D deficiency, and TAS levels were decreased. In light of these findings, it may be suggested that oxidative/anti-oxidative balance shifts in favour of oxidative side in vitamin D deficiency.

