"Mircea cel Batran" Naval Academy Scientific Bulletin, Volume XVI – 2013 – Issue 2
Published by "Mircea cel Batran" Naval Academy Press, Constanta, Romania

THE ANTIOXIDANT EFFECT OF THE VITAMINE E IN A DEEP DIVING TEST AT 180 METRES DEPTH

CEZARINA –LORELAI DINCU[1]
[1] Naval Medicine Center , Constanța, Romania

Abstract: *A deep saturation dive induces a hepatic,myocardic and biliary system disturbances. As a result, plasma activities of both transaminases (aspartate aminotransferase (AST) and alanine aminotransferase (ALT),alkaline fosfatase, lactat dehidrogenase and gamma-glutamyl transferase have increased significantly.*

Assuring that the liver and heart dysfunction was attributable to oxidative stress, we examined the effects of supplementation of the antioxidant vitamin E on liver and heart function in saturation divers. The antioxidants taken appeared to prevent a hepatic and miocardic disturbance, indicating that a deep saturation dive provokes liver and heart dysfunctions probably due to oxidative stress.

We recommend that saturation divers should take supplements of antioxidants.
Key words: *liver function, oxidative stress, antioxidants, saturation divers*

1 INTRODUCTION

In saturation diving, the divers live under pressure in a hyperbaric environment, for the whole duration of the work from several days to a few weeks and are decompressed to the surface pressure only once, at the end of their work. Therefore the risk of "bends" is significantly reduced (Brubakk et al.2005 DORAN et al.1985)

The use of the antioxidants in the prevention of the effect of oxydative stress associated to saturation diving is frequently mentioned in literature. Acute oral intake of antioxidants (ex.vitamin E) to divers can reduce alterations in cardiovascular function, particulary acute endothelial dysfunction that are caused by a diving saturation.(Obad et al.2006 Ikeda M,Nakabayashi K2004, Obad et al2007.)

Vitamin E has many biological functions, the antioxidant function being the most important and best known. Other functions include enzymatic activities, gene expression and neurological functions (Brigelius-Flohé R, Traber MG1999)

As an antioxidant, vitamin E acts as a peroxyl radical scavenger, preventing the propagation of free radicals in tissues, by reacting with them to form a tocopheryl radical which will then be oxidized by a hydrogen donor (such as Vitamin C) and thus return to its reduced state. As it is fat-soluble, it is incorporated into cell membranes, which protects them from oxidative damage. (Herrera; Barbas, C (2001))

Vitamin E also plays a role in neurological functions, and inhibition of platelet aggregation . (Muller, D.P. 2010.)

Vitamin E also protects lipids and prevents the oxidation of polyunsaturated fatty acids .(PUFA. Brigelius-Flohé R, Traber MG 1999)

The aim of these work was to study the effects of saturation diving inmersion on plasma antioxidant defenses in the particular conditions of „Divers Centrum of Constanta „ and to contribute with requisite and useful informations in domain.

2 MATERIALS AND METHODS

Some typical aspects to realize the investigation in DIVERS CENTER CONSTANTA:

- the diving team-twelve men with the age between 30 - 42 years, well trained and healthy,distributed in three groups for each saturation diving (four members); two of them were treated with vitamin E and the other two were as control.

-the following conditions have been simulated:in BAROCHAMBER:

- maximal depth - 180 metres

-pressurization duration - 10 minutes

-respiratory mixture - HELIOX (He-O)

The total duration of investigations - eight days ,from which four days,living in BAROCHAMBER {PRESSURE CHAMBER } ,two days - observations and analysis in PRESTART and two days - observations and analysis in POST SATURATION DIVING.

The analytical proceeding included :

-the investigations of coagulation parameters, Quick test and INR(INTERNATIONAL NORMALIZATED RATIO) as a ratio between protothrombin time of the patient and normal protothrombine time, performed by a SYMEX CA-500 COAGULOMETER standardized with control plasma.

-the evaluation of the discrete cytolisis by enzymatic activities with a DIMENSION analiser .

-the variation of hormonal concentration,T4,T3, and TSH ,according to R.BANICA 2007.

-the interpretation of them and their statistical evaluation according to
J.WALLACH and JENSEN Al.

3 RESULTS AND COMMENTS

The expression of analytical data in histogram form and their statistical evaluation permits to estimate the effects of hyper barismstress - included the oxidative stress - and the intervention of vitamine E. as protector agent by:

-the qualitative and quantitative comparison with normal limits and the trend of the data within these limits;

- the qualitative and quantitative evaluation between variants, before/after diving, with/without vitamine E;

-the comparison of individual responses within the human group who lived in the same time under the same conditions.

The retrospect observations ,during ten years (2001 – 2010) showed the alteration of examinated parameters concerning coagulation indicators,hormonal concentration, and enzymatic activities.These variations were imposed by the stress conditions of diving in saturation.The levels of variations have been considered just as response signal and not as a clinical alert.

Thus it was evident the following:

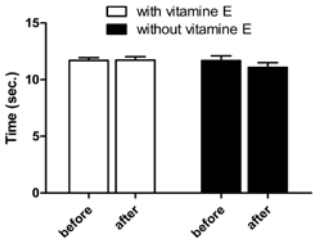
- the increase with 10% for Q.T and I.N.R.against their levels in PRESTART physiological motivated by the intervention of gas-bubble formed during the decompression; on these adhere the plasmatic lipids and proteins forming an assembly which starts the coagulation development (ANDERSEN 2002 cIted by C.DINCU 2012)

- the hormonal corelations between TSH,T4,T3, pointing a semnificative increase of TSH, as a result of adaptation to thermic variation (HAMILTON R.W.2003 cited by C.DINCU 2012} and a decrease of T4,T3,concentration as a consequence of thyroid affectation;

- a signifcant increase of enzymatic activities as a result of hepatic tissue cytolisis
{-SHANK E.2003cited byC.DINCU 2012}; the sensitivity of ALT,AST, GGT,are remarkable, their increase exceeding the normal limits,in contrast with LDH ,and ALP which keep their evolution into normal limits; however the increase of activities may be associated with digestive troubles initiated by hyperbaric stress.
The achieved researches bring the paralelle situations of the oxidative stress effects compared to antioxidant and protective effects of vitamine E .

Fig.1. Q.T. Limits of the means

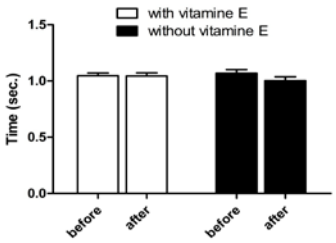
T. Quick Limits of means variation



	With vitamine E		without vitamineE	
	Before	after	before	after
Domain of variations	11,0-12,7	10,5-12,3	10,3-12,4	9,8-12,2
mean±DS	11,7±0,52	11,7±0,67	11,8±0,92	11,06±0,93
C.V.%	4,5	5,7	8,0	8,4

Fig.2. INR- Limits of means variations

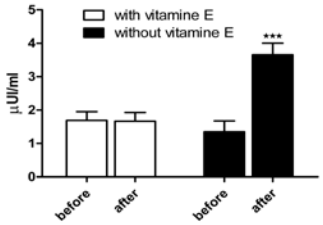
Variația INR



	With vitamine E		without vitamineE	
	Before	after	before	after
Domain of variations	0,98-1,15	0,94-1,10	0,92-1,14	0,88-1,09
mean±DS	1,05±0,0 5	1,045±0,06	1,07±0,07	1,0±0,07
C.V.%	5,0	5,7	7,0	7,4

Fig.3 Limits of means variations

Variația TSH

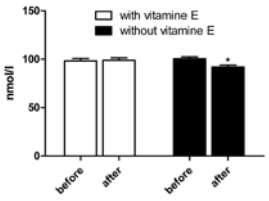


	With vitamine E		without vitamineE	
	Before	after	before	after
Domain of	0,74-2,44	o,72-2,43	0,52-2,46	2,65-4,75

		variations		
mean±DS	1,70±0,35	1,66±0,45	1,35±0,71	3,65±0,77
C.V.%	20,0	27,0	22,0	23,0

Fig.4 Limits of means variations

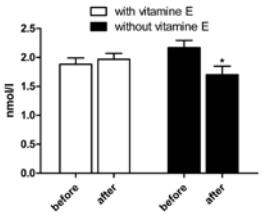
Variația T4



	With vitamine E		without vitamineE	
	Before	after	before	after
Domain of variation	89,0-106,0	90,0-106,0	94,0-106,0	83,0=97,0
means±D.S.	98,2±6,0	98,8±5,7	100,5±4,2	91,8±4,6
C.V.%	6,0	6,0	4,2	5,0

Fig.5 Limits of means variations

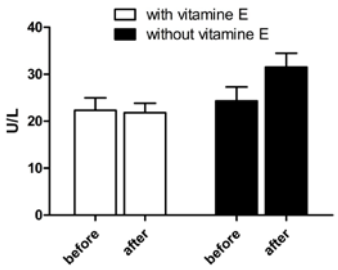
Variația T3



	With vitamine E		without vitamineE	
	Before	after	before	after
Domain of variations	1,5-2,2	1,6-2,3	1,8-2,6	1,3-2,3
mean±DS	1,89±0,24	1,96±0,22	2,2±0,28	1,7±0,33
		1,75±0,3		
C.V.%	12,7	11,6	13,0	19,0

Fig.6 Limits of means variation AST *

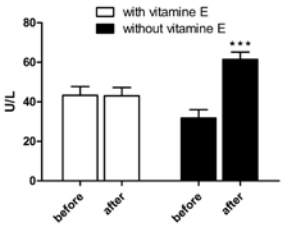
Variația AST



	With vitamine E		without vitamineE	
	Before	after	before	after
Domain of variations	15,0-33,0	15,0-29,0	15,0-33,0	21,0-39,6
mean±DS	22,33±6,0	21,83±4,4	24,33±6,6	31,5±6,6
C.V.%	26,0	20,2	27,2	21,2

Fig.7 Limits of means variations ALT *

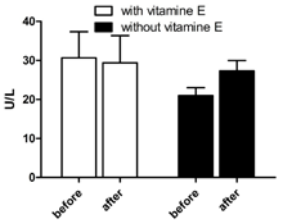
Variația ALT



	With vitamine E		without vitamineE	
	Before	after	before	after
Domain of variations	36,0-41,0	37,0-40,0	20,0-44,0	
mean±DS	39,0±1,8	39,0±1,14	31,83±9,35	61,5±8,24
C.V.%	4,5	3,0	19,0	13,0

Fig 8 Limits of means variations

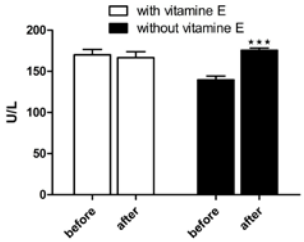
Variația gama



	With vitamine E		without vitamineE		
Before	after	befor	after	Domain of Variations	18.0-39.0 17,0 -37,0
	14,0-28,0	21,0-39,0			
mean±DS	31,5±4,6	30,0±4,5		21,0±4,54	
C.V.%	14,8	15,0		21,6	

Fig.9 Limits of means variations LDH

Variația LDH

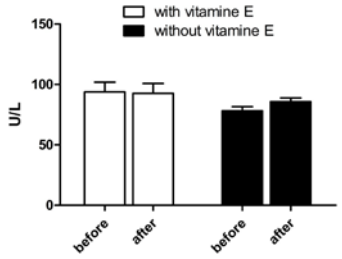


With vitamine E		without vitamineE	
Before	after	before	after

Domain of variations	147,0-185,0	139,0-184,0	120,0-155,0	165,0-184,0
mean±DS	170±14,6	166,5±16,5	139,5±10,7	175,5±6,5
C.V.%	8,5	10,0	7,6	3,7

Fig. 10 Limits of means variations ALCALINE FOSFATASE

Variația fosfatazei



	With vitamine E		without vitamineE		
	Before	after	before	after	
Domain of variations	76,0-122,0	74,0-120,0	68,0-92,0	**Nr. patients**	
mean±DS	98,8±18,2	92,7±18,3	78,2±7,5	85,ס±ס,ס	C.V.%
	5,2	9,7	9,5	7,6	

CONCLUSIONS

The noticeable effects of vitamine E are evident but the biological responses are different from each other by individual range of variations before and after diving for each of analysed parameters.

The percentage comparison of the modified levels induced by stressed agents and the antioxidant administration shows distinct degrees of sensitivity.Thus, the enzymatic equipment is the most responsive by modification of activity due to oxidative stress and anti oxydant administration; followed by the hormonal concentrations ;in the end the coagulation parameters are the most stable.

The distribution of data around means may be corelated with the individual reaction and motivates human organism behaviour.

The obtained results pointed that the human organism of divers, answered to the aggression of the oxidative stress and to the effects of the support –

vItamine E.

Certainly the biological equipments reacted tipically ,on the one hand in the trend described in literature, on the other hand, connected with particular conditions of the place where the works had performed.

This study shows that antioxidant treatment with vitamin E reduces the endothelial dysfunction of divers.

Also, it has been emphasized the importance of vitamin E used as an antioxidant that protects against free radicals formation at professional divers that dive at great depth.

The observations lead to the further researches with the aim to find another natural antioxydants and to put them in the preventive and surveillance of saturation divings.

REFERENCES

1.R.BANICA Analize de laborator si alte explorari diagnostice. Ed.MEDICALA ,2007

2.Brigelius-Flohé R, Traber MG . "Vitamin E: function and metabolism". *FASEB J.* 1999,**13** (10): 1145–55

3. Brubakk et al. Optimal decompression from 90MSW.J Physiol 2005,578/3/859

4. C. DINCU A.Deftu M.L. FLONTA . Long term physiopathological changes in proffessional divers – a longitudinal study Romanian J. Biophys 22 .2 received at editorial board sept. 2012-

5. DORAN, G.R., L.CHAUDRY, A.O.BRUBAKK, M.P.GARRARD, Hyperbaric liver dysfunction in saturation divers, *Undersea biomedical Res*., 1985, **12**, 151–164

6. Herrera I ; Barbas, C . "Vitamin E: action, metabolism and perspectives". *Journal of Physiology and Biochemistry*2001,**57** (2): 43–56

7. Ikeda M,Nakabayashi K,Supplementation of antioxidants prevents oxidative stress during a deep saturation dive,J Exp Med.2004, 203(4):353-357

8. JENSEN Al. KJELGAARD-HANSEN M. Method comparison in the clinical laboratory VET.CLIN,PATHOL. 35(3)276-86

9. Muller, D.P. . "Vitamin E and neurological function. Review". *Mol. Nutr. Food Res* 2010,**54** (5): 710–718

10. Obad et al. The effects of acute oral antioxidants on dving induced alteration in human cardiovascular function.J Physiol2006,578/859-870

11. Obad et al. Vitamin C and E can reduce alterations in cardiovascular function,particulary acute endothelial function,J. Physiol.2007, 578/124-129

12. J.WALLACH.Interpretation of diagnostic tests. Ed.MEDICALA BUCURESTI , 2007,20-64