The Effect of solar UV Rays on some biological activities of divers

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Abstract

Vitamin D3 or cholecalciferol occurs in fish liver and is produced in human skin by UV light. The UV Rays accomplish inactive pro vitamin transformation to the active vitamin. To determine the effect of solar UV Rays on some biological activities of divers, two equal groups of divers, ten divers each, participated in the study. Group (1) was exposed to sunlight during the experiment for one month and dive for one hour, three times/week, Group (2) was unexposed to sunlight and dived after sunset for one hour, three times/week, for one month. Cardiovascular assessment, pulses rate, Malondialdehyde, Superoxide dismutase, together with muscle strength assessment and IGF"1", Vit D3 concentration were performed in both groups before and after the experiment. Results revealed a positive change in the cardiovascular system, in oxidant and antioxidant activities, together with muscle strength and IGF"1", and Vit D3 concentration in case of the divers performing exposed to sunlight compared to the Group of divers unexposed to the sunlight during the experiment duration. Exposure to the sunlight-induced improvement due to the activation of pro-Vitamin to the active state by UV Rays. It may be concluded that Vit D3 induced benefit effects on the cardiovascular system, immunity, and strength activity with increased IGF"1", and Vit D3 concentration of divers.

Keywords: Solar UV Rays, Cardio Vascular System, immunity, Vit D3, Muscle strength, Divers.

Introduction:

Vitamins are organic compounds found in natural foods; they are required in minute amounts used in average growth, maintenance, and reproduction. So, for normal nutrition and health (Murrayet Al, 2009).

Vitamins are classified into Fat-Soluble Vitamins; A, D, E, K, and water-soluble Vitamins; C, B, inositol, PABA, choline.

Vitamin D3 (cholecalciferol) is found in fish liver and produced in the skin by ultraviolet light. Vit D is considered a prohormone, and Vit D3 is a hormone that stimulates many organs and tissues, bones and intestines, and kidneys. Also, Vit D3 promotes bone resorption and calcium mobilization to raise calcium and phosphorus levels in the blood in association with the parathyroid glandGuyton, Hall. 2006].

Gurle Ketal (2002) added that Vit D3 is the most crucial compound derived from sterols and is formed in the skin

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due to irradiation of 7- dehydro cholesterol, a substance typically found in the skin ultraviolet rays from the sun. Consequently, appropriate exposure to the sun prevents Vitamin D deficiency. The additional Vit D compounds that we ingest in food are identical to the cholecalciferol formed in the skin, except for substituting one or more atoms that do not affect their functions.

Strauss and Aksenov (2004) stated that nutrition and diving are subjects that receive little attention and consideration from the researchers, as a balanced diet is essential for health, fitness, and performance. Also, people with nutrition problems tend to be discouraged from sport diving. There are nutrition considerations for the divers that contribute to the safety and energy requirements of the divers, as diving is associated with energy needs, which is dependent on the level of activity, diving depth, and the water temperature. Also, energy requirements may increase by 30 percent in deep dives.

Lorisherlocket, Al. (2013) reported that the physical properties of the water environment modified many physiological aspects of human function and thus directly affected exercise physiology. They also added that many physiological effects are produced during immersion that could affect executive function due to the water's security sensation. Also, the reduction in pain is stimulated by hydrostatic pressure, the off-loading of joints by the upward force of buoyancy. Thus, water may be the ideal medium for improving nervous system functions. Physical activity is widely acknowledged as essential for growth and normal development. It also contributes to a lower risk of chronic diseases; the current public health message regarding physical activity and the importance of increasing incidental physical activity is a good starting point for improving health status, particularly in those who are inactive.

(Bouchard 2001) reported that physical activity is a behavior that has several dimensions: energy expenditure, stresses, and strain associated with weight-bearing, physical fitness (performance and health-related). To preserve physical fitness and thus the quality of life, it is vital to understand the extent to which muscle strength and flexibility contribute to performance.

Guyton and Hall (2008) assessment of physical fitness is critical in recording the improvement of exercise programs. It should include the cardiovascular system, muscular strength abilities, and flexibility, including the fundamental assessment of athletic fitness (Hatfield, 2013).

Immunity and nutrition are the main constituents of athletic health. Immunity may be classified as a body's defense system, including humoral and cellular systems. Both react to antigens that are foreign to the body, such as bacteria or foreign tissue; humoral immunity is due to circulating antibodies. Cellular immunity is responsible for delayed allergic reactions. It constitutes a significant defense against bacterial infections (Ganong, 1997). Physical fitness and

health are acting together to reach high athletic performance.

The study aimed to determine the effect of solar UV Rays on some biological activities of divers.

Hypothesis of the study:

It is hypothesized that solar UV Rays positively affect some biological activities of divers.

Research Procedures:

Research method:

The researchers used the experimental method (pre-post) measurement of control and experimental groups due to the suitability of the study.

Research sample:

Twenty divers participated in the survey, G1 (10) divers exposed to sunlight, G2 (10) divers non exposed to sunlight.

All participants dive in Hurghada District.

Table (1)

Homogeneity of the characteristic features of Age, Height, Weight of divers

N=20

Variables	Mean	SD	Median	Skewness
Age (years)	27.5	0.6	27.3	1.3
Weight(kg)	69.9	2.8	69.7	0.5
Height	171.8	2.6	172	-0.18

In table (1) the Skewness were between (±3) indicating homogeneity of the sample.

Data Collecting Tools:

Height by using Restameter.

Weight by using a medical scale.

There was Cardiovascular endurance by using a 12-minute swimming assessment.

Pulse rate by using Pulse Meter.

Muscle strength (for arm) by using overhead Medical ball (3kg)for leg by using steady broad jump.

Malondialdehyde by using a spectrophotometer.

There was Superoxide dismutase by using a spectrophotometer.

There was an Insulin growth factor by using the Elisa technique.

The total was by using the colter counter, 25 (OH) D using the Elisa technique.

Main study:

Group (1) was exposed to UV sunlight, diving for one hour daily, three times per week for one month.

Group (2) was unexposed to UV sunlight, diving for one hour daily, three times per week for one month after sunset. Pre-post measurement of the variables for the two groups.

Enette (2015) reported that Vit D status might be achieved by sensible sun exposure for 30 minutes for dark skin pigmentation, arms, legs, back at close solar noon, several times a week.

Statistical Data Analysis using (SPSS) including:

Arithmetic Mean.

Median.

Standard deviation.
Skewness.
Man-Whitney (U) test.
$P > 0.05$.

Results and Discussion

Table (2,3) indicated that fitness results concerning pulse rate, and cardiovascular endurance assessment, all variables significantly changed to the favor of the experimental Group (1) compared to non-exposed Group (2). The decreased pulse rate noted and the increased cardiovascular endurance assessment revealed an increased fitness capacity due to exposure to sunlight and diving exercises, which lasted one month compared to the non-exposure to solar UV Rays and exercise diving.

The increased fitness remarked may be due to the action of Vit D_3 on the cardiovascular system leading to the high blood supply to the active muscles of divers, with increased oxygen, inducing increased energy production, which in turn helps the mechanism of muscle function. Hence, the positive results generated protein synthesis and grown muscle fibers and cardiovascular system strength, reduced pulse due to parasympathetic action.

The study results followed those of Haiam Ahmed 2012, El Amin (2017). Walshet Al (2011) added that Vit D is a highly regulated steroid hormone system, Vit D_3, present in food of animal origin such as fish liver oil. The classical effect of Vit D includes the action on the bone to maintain calcium homeostasis and bone density.

They also reported nonclassical effects on diabetes, increasing leucine in muscle protein synthesis, the cardiovascular system, cardiac myocytes, vascular smooth muscle cells, and aortic endothelial cell activation. Moreover, they reported leading to elevated immune response stimulated the differentiation of myeloid stem cells towards monocyte-macrophages.

Table (2-3) indicated that Vit D (UV Light) possesses an activation action on total leucocyte counts, superoxide dismutase, together with a suppression effect on Malondialdehyde. It meant that the supplementation of (UV Light) induced an antioxidants effect upon divers, leading to better immunity improvement.

Bouchard (2001) reported that sports supplementation is part of the integrated nutrition approach; scientific studies show that supplementation may benefit physical and mental performance. Also, it can improve immunity and health status.

Guyton et al. (1995) reported elevated counts of total leucocytes in response to exercise and stress.

And Hatfield (2013) and Magini (2007) reported an improvement in health and immunity due to ingestion of natural products as Vitamins, minerals and SAME, and

Whey proteins through strengthening epithelial barriers and cellular humoral response.

Heshmat et al. (2013) added that several interleukins are secreted by the helper cells in response to exercise and that interleukin has an effect on increasing some cells like cytotoxic cells.

Grossman et al. (2004) added that interleukin induces a positive effect in helper t cells activation, which enhances the body's immune response to invading antigen.

Table (3) also revealed a decreased concentration of Malondialdehyde following (UV Light) administration together with an elevated SOD in response to (UV Light) which indicated a positive role induced by Vit D_3 as a stimulator of immune function and health benefits supplement.

In addition to the action of Vit D_3 on immunity and immune system, the divers are more suspected to hypoxia more than other sports, this may induce, another stimulation effect as a stress factor leading to stimulate stem cells proliferation and growth factors which affect positively the immune system, as interleukin and tumor necrosis factor (TNF-α), both the hypoxia and cytokine-induced activation of hypoxia inducible factor 1, and signaling path ways, leading to increase immune reactions as described by [Thomas et al 2005, Julian et al 2005, Barker et al 2014] pulse rate and cardio vascular assessment (Table 2-3) indicated a decreased pulse rate and increase cardiac assessment in the favor of (UV Light) Group (1) compared to the non-exposed Group (2) the positive effect induced due to the (UV Light) exposed of divers, indicated that Vit D_3 may affect the cardio vascular system through a direct effect on heart and blood vessels or through an indirect effect through central nervous system and autonomic nervous system leading to decreased pulse rate and increasing stroke volume and cardiac output, and indication of the vitality of the cardio vascular system.

By following the researchers [Guyton et al., 1995, Uemura et al.,2004, Brengelman, 2003], muscle strength assessment together with IGF. (Table2,3) revealed an increased muscle strength of the arms and legs and IGF concentration in the case of divers subjected to (UV Light). Group(1) compared to non-exposed divers Group(2), which indicated that Vit D might affect muscle fibers positively and increase muscle mass due to the effect of Vit D on stimulating IGF concentrations.

This result follows Close et al. (2013), Wyon et al. (2014). Also, Girgis et al. (2013) and Sato et al. (2005). Barker et al. (2011) Reported the expression of genes that influences skeletal muscle through the expression of genes that impact muscle growth and differentiation or through non-

genomic effect, which include modulating sarcoplasmic calcium uptake and cell signaling. Vit D deficiency induces atrophy of muscle fibers and impairs sarcoplasmic calcium uptake. It prolongs time to peak contractile tension and relaxation.

As for Vit D_3(25(OH)D) assessment for exposed Group and non-exposed Group to UV Rays, the data of Table(5) indicated a significant increased Vit D_3 in the exposed Group compared to non-exposed. In the case of the exposed Group, Vit D_3 reach a level of 30.4±107 mg/ml, which is reported to be sufficient of Vit D_3 concentration. Wyon et al. (2014) stated that Vit D_3 is necessary for the health of skeleton functions, and it is recommended for athletes and non-athletes.

From the previous discussion the hypothesis of the study has been realized it may be concluded that:

Solar UV Rays may affect positively cardio vascular system, immune system together with muscle function and strength of divers.

It is recommended to:

Expose athletes to sun specially arms, legs and back at close to noon several times a week or supplementation and dietary intake of Vit D_3/daily.

Table(2)
CV assessment, Pulse Rate, Immunity, Muscle Strength before the experiment of Group(1),(2) of divers

Variables	Group(1)		Group(2)		Sig
	M	SD	M	SD	
Pulse Rate c/min	72.4	5.6	72.1	4.9	NS
CV assessment (meters)	584	6.7	591	5.8	NS
Malondialdehyde (mmol/ml)	4.3	0.2	4.2	0.3	NS
S O D (mmol/ml)	6.7	0.6	6.5	0.4	NS
Body muscle Str. Arms cm	9.20	1.8	9.17	1.4	NS
Legs cm	163.4	5.3	160.2	6.1	NS
I G F (pg/ml)	12.4	2.3	11.9	2.5	NS
T.WBC (cells/ul)	5080	20.4	4980	19.3	NS

Table (2) indicated non-significant differences between Group(1) exposed to UV Rays and group(2) non-exposed to UV Rays before experiment.

Table (3)
variables changes in Group(1) Exposed (UV Rays) after the experiment

Group (1)					
Variables	**B**		**A**		**Sig**
	M	**SD**	**M**	**SD**	
Pulse Rate c/min	72.4	5.6	68.2	3.1	S
CV assessment (meters)	584	6.7	658	6.1	S
Malondialdehyde (mmol/ml)	4.3	0.2	1.36	0.3	S
S O D (mmol/ml)	6.7	0.6	9.3	0.2	S
Body muscle Str. Arms cm	9.2	1.8	11.2	1.9	S
Legs cm	163.4	5.3	228	6.1	S
I G F (pg/ml)	12.4	2.3	25.2	3.4	S
T.WBC (cells/ul)	5080	20.4	9310	21.3	S

Results indicted significant differences for the favor of post experiment

Table(4)
variables changes of Group(2) non-exposed to UV Rays after experiment

Group (1)					
Variables	**B**		**A**		**Sig**
	M	**SD**	**M**	**SD**	
Pulse Rate C/min	72.1	4.9	72.3	4.2	NS
CV assessment (meters)	591	5.8	596	5.5	NS
Malondialdehyde (mmol/ml)	4.2	0.3	4.3	0.4	NS
S O D (mmol/ml)	6.5	0.4	6.6	0.5	NS
Body muscle Str. Arms (m)	9.17	1.4	9.20	1.5	NS
Legs cm	160.2	6.1	158.4	5.7	NS
I G F (PG/ml)	11.9	2.5	12.2	2.6	NS
T.WBC (cells/ul)	4980	19.3	4977	21.4	NS

Group(2) indicated non-significant changes of variables after experiment

Table (5)
Vit D_3 (25(OH)D) of Group(1) exposed to UV Rays and Group(2) non-exposed before and after the experiment

Variables	Group(1)		Group(2)	
	B Exp.	A	B Non-Exp.	A
VIT D_3 25(OH)D Mg/ml	21.8±1.5	* 30.4±1.7	22.1±1.6	ns 22.4±1.2

Exposed Group (1) showed a significant increased Vit D_3 after experiment while non-exposed Group (2) showed non-significant change.

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