**Vitamin D3 for Health and Muscle Functions of Athletes**

Mohammed Nader Shalaby, Mona Mostafa Abdo Sakoury, Salman Mohammed Harthi, Faleh Mohammed Alshlawi, Marwa Mohammed Alhajji, Zahraa Hassan Alshaikh, Alhanouf Hassan Aljaber

1 Biological Sciences and Sports Health Department, Faculty of Physical Education, Suez Canal University, Egypt
2 Faculty of Applied Studies and Community Service – Imam Abd Al-Rahman Al-Faisal University, Saudi Arabia
3,5 Laboratory Technician, Saudi Arabia
4 Emergency Medical Technician, Saudi Arabia
6 Medical Technologist, Saudi Arabia

**Correspondence:** Mohammed Nader Shalaby; Biological Sciences and Sports Health Department, Faculty of Physical Education, Suez Canal University, Egypt
Email: dr.m.nader@suez.edu.eg

**ABSTRACT**

It is well known that vitamin D3 is important for bone and skeletal health. Research, however, indicates the necessity of vitamin D3 for muscle and immune function, inflammation and athletic performance. The purpose of the study is to examine the effect vitamin D3 supplementation on athletic health and muscle functions. The Researchers used the experimental method of Pre-post assessment of one experimental group due to the suitability of the nature of the Research. The sample comprised 20 young athletes, they ingested a recommended dose of 2000 IU/ Day for two months (10/11/2019 - 30/11/2019). Data were determine pre-post ingestion of vitamin D3 for 25(OH)D, Insulin growth factor(Angiotensin in converting Enzyme), nitric oxide, pulse rate blood pressure and of Growth hormone. 5ml venous blood was drawn from each participant pre-post vit D3 ingestion. The Results indicated a significant positive change of the study variables after Vit D3 ingestion. It is concluded that Vit D3 supplementation may affect muscle function and health of the athlete. It is Recommended that Vit D3 levels should be checked on annual basis in all athletes for their health.

**Keywords:** Vit D3 supplementation, muscle functions, Health, performance, athletes, Hormones.

**Correspondence:**
Mohammed Nader Shalaby
Biological Sciences and Sports Health Department, Faculty of Physical Education, Suez Canal University, Egypt
Email: dr.m.nader@suez.edu.eg

**INTRODUCTION**

Vitamin D is considered a vitamin, meaning an Organic Compound found in food and is needed in small amounts for the health and musculoskeletal system, it can also be met through synthesis in the skin by exposure to ultraviolet B (UVB) radiation in sunlight to convert 7-Dehydrocholesterol which is present in the skin to D3 (cholecalciferol). Vitamin D is converted in the liver to the storage form 25(OH)D, and is found in the diet like salmon, mackerel, Sardine, Tuna, Mushroom, milk, yogurt, fruit juice, Cereals and egg yolks. The reported association of Vitamin D3 to the fast twitch fibers (type 2 muscle) and Vit D supplement showed a significant improvement of the atrophy of type 2 muscle after Vit D treatment.

Erythropoietin (EPO) is a hormone naturally Produced in the body to stimulate the production of red blood cells, which in turn increases the oxygen carrying capacity of the blood to be delivered to exercising muscles, to produce energy that help performance. Kao et al. added that EPO induced many other factors including combating the fatigue that cause drop in pH levels and boost Nitric oxide and enhanced nutrient delivery to stimulate muscle growth. Naturally produced EPO in the body stimulates the production of red blood cells from stem cells that originate in bone marrow and there are substances leading to increased EPO such as cobalt, Arachidonic acid and Echinacea.

Insulin growth factor1 is the most Studied growth factor inducing muscle growth together with insulin growth factor2 (IGF1) can be found in the cytoplasm and the nucleus and act as angiogenesis, meaning it stimulate capillaries and blood vessels formation, also help wound healing, tissue repair and embryonic development and differentiation of heart, bone and brain, they also added that IGF1 is up regulated in response to inflammation via mediators such as TNF and nitric oxide which is a powerful vasodilator, increasing blood supply to the different organs. Ganong (7) stated that growth hormone performs its effect on target tissues through liberation of Somatomedin(c) (IGF1) and IGF2. These are secreted from the liver and other tissues like skeletal muscle. He added that there are some vitamins B1, B12, E, C, A together with Calcium, phosphorus, Zinc and Molybdenum affecting growth. Angiotensin-converting Enzyme is a zinc metal peptidase important for blood pressure control and water and salt metabolism. It deaves the C-terminal dipeptide from angiotensin 1 to produce angiotensin 11, a potent vasopressor and inactivates bradykinin a potent vasodilator, they also added that ACE inhibitors are now used clinically to treat hypertension.

Shahmora et al. and Massidda et al. reported that ACE gene is one of the most popular gene studied in sport. As for Nitric Oxide, Hussain reported that it plays an important role in many Physiological functions, its formation in the vascular endothelium, in response to stimuli, maintains a Vasodilator tone that essential regulate the blood flow and also blood pressure, so it control muscular tone of the blood vessels of the male genitals, where it may relax blood vessel by pathway that are dependent and / or independent of granulate cyclase. Suboptimal Vit D status as widespread among the general population worldwide, even among athletes in Sunny countries when sun is a voided on skin is shielded. They added that insufficient sunlight exposure is an important reason together with poor Vit D intake, as studies find that athletes do not reach the recommended Vit D in most countries. They also found that only 5% of college athletes met the RDA from food alone.
The purpose of the study is to examine the effect of vitamin D₃ supplementation on athletic health and muscle functions.

**Research Hypothesis**

It is hypothesized that Vit D₃ supplementation may affect positively athletic health and muscle functions.

**Research Procedures**

Research Method: The Researchers used the experimental method of pre-post measurement of one group of athletes due to its suitability to the nature of the study.

Research Samples: comprises of (20) young athletes.

### Table 1. Basic characteristics of the sample m= (20)

<table>
<thead>
<tr>
<th>variables</th>
<th>A. Mean</th>
<th>Median</th>
<th>SD</th>
<th>skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>18.64</td>
<td>18.50</td>
<td>0.43</td>
<td>0.08</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>181.2</td>
<td>182.0</td>
<td>2.9</td>
<td>0.07</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>78.9</td>
<td>79.1</td>
<td>1.7</td>
<td>-0.93</td>
</tr>
<tr>
<td>Pulse rate c/m</td>
<td>84</td>
<td>83.9</td>
<td>12</td>
<td>1.02</td>
</tr>
<tr>
<td>BPres.syst</td>
<td>124</td>
<td>124</td>
<td>8</td>
<td>0.48</td>
</tr>
<tr>
<td>Diast</td>
<td>80</td>
<td>80</td>
<td>5</td>
<td>0.56</td>
</tr>
</tbody>
</table>

The Table indicated that skewness is (±3) meaning the homogeneity of the sample.

**Research Community**

Human Community

The research Community include athletes, whose number (20) athletes, aged between (17-19 years). The different variables studied 25 (OH)D, growth H, IGF (1), Nitric oxide, and ACE were determined in clinical lab at Cairo also, blood pressure and pulse rate were determined Blood samples (5ml) were collected in special tubes to ice box in the morning for estimation of different variable a pre-post Vit D₃ administration for two months between 1/10/2019 to 30/11 /2019. The Experiment group was reported to administer Tablets containing 2000 IU of Vit D₃ daily for two months (13), while the players continue their usual training regularly.

Table 2. Pulse rate, Blood Pressure Pre-post Vit D₃ ingestion

<table>
<thead>
<tr>
<th>variables</th>
<th>pre</th>
<th>post</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>m</td>
<td>SD</td>
<td>m</td>
</tr>
<tr>
<td>Pulse rate</td>
<td>84</td>
<td>12</td>
<td>78</td>
</tr>
<tr>
<td>Blood Pressistol</td>
<td>124</td>
<td>8</td>
<td>120</td>
</tr>
<tr>
<td>Diast</td>
<td>80</td>
<td>5</td>
<td>78</td>
</tr>
</tbody>
</table>

Table (2) revealed a significant decreased Pulse Rate and Blood pressure post Vit D₃ administration.

Table 3. Pre-post Vit D₃ ingestion of 25 (OH)D, IGF, and Growth H concentration

<table>
<thead>
<tr>
<th>variables</th>
<th>pre</th>
<th>post</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>m</td>
<td>SD</td>
<td>m</td>
</tr>
<tr>
<td>Vit D₃</td>
<td>23.6</td>
<td>1.5</td>
<td>35.3</td>
</tr>
<tr>
<td>25 (OH)D mg/ml</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IGF (pg/ml)</td>
<td>43.2</td>
<td>3.2</td>
<td>87.6</td>
</tr>
<tr>
<td>Growth H (pg/ml)</td>
<td>3.8</td>
<td>0.9</td>
<td>6.9</td>
</tr>
</tbody>
</table>

Table (3) indicated a significant increased 25(OH)D, IGF (1), growth H, Post Vit D₃ ingestion.

Table 4. Pre-post Vit D₃ ingestion of Nitric oxide and Angiotensin converting enzyme

<table>
<thead>
<tr>
<th>variables</th>
<th>pre</th>
<th>post</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>m</td>
<td>SD</td>
<td>m</td>
</tr>
<tr>
<td>Nitric oxide</td>
<td>32.8</td>
<td>2.2</td>
<td>45.1</td>
</tr>
<tr>
<td>(mm) nitrite</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACE (mg/ml)</td>
<td>147.4</td>
<td>1.6</td>
<td>202.7</td>
</tr>
</tbody>
</table>

Table (4) indicated a significant increase of nitrite and decreased ACE post vit D₃ ingestions.
DISCUSSION

Table (3) indicated an increased concentration of Vit D3 (250H) D of the athletes after Vit D3 administration (2000 lu) daily for two months.

The Results: revealed that Vit D3 of athletes were insufficient pre ingestion of Vit D3 (23.6 ± 1.5 mg/ml) increased to 35.3 ± 2.4 (mg/ml) This is in agreement with the endocrine society that defines Vit D3 insufficient as 21 mg/ml and above to 30 mg/ml, whereas Vit D3 ingestion reached the sufficient level of Vit D3(13).

This is in accordance with Maroon et al. (14) that indicated that sufficient Vit D3 is important for muscle growth that induce better condition for performance and fitness of the athletes.

Data Presented in (Table 3) indicated that Vit D3 administration led to increased concentration of growth hormone and IGF(1). These results are in accordance with previous studies (15,16).

A current hypothesis to explain these results holds that both growth hormone and IGF(1) affect muscle growth directly as indirectly through the conversion of stem cell of the muscle into muscle fibers, Overall, it seems that growth hormone and IGF(1) can act both in cooperation and independently to stimulate pathways that lead to growth, as growth hormone probably combines with Circulating and locally produced IGF(1) in muscle tissues to produce the growth effect(17,18).

Table (4) revealed an increased nitric oxide together with a decreased ACE Concentration post Vit D3 administration, that indicates that Vit D3 ingestion may decrease blood pressure of the athletes and may act as ACE inhibitor on Table (2) indicated a decreased blood pressure post Vit D3 ingestion also the increased nitric oxide as nitrite may help in blood vessel vasodilatation and increased blood flow together with Rbc increased due to dilatation of vessels and may activate erythropoietin as a erythrocyte stimulator.

These results are in accordance with Galal (19) that noted that ACE is produced by the kidney that convert angiotensin one to angiotensin (2) which in turn increased blood pressure. El Amin (20)Added that Vit D3 decreased blood pressure through inhibiting ACE that elevate hypertension and dilatation of blood vessel through the action of nitric oxide.

Table (2) denoted a decreased pulse rate indicated that Vit D3 administration may elevate Fitness of athletes

As for Nitric oxide increased after vit D3, administration, it diffuses to smooth muscle cells of the blood vessels, where it activates guanmmyl cyclase, which in turn mediates the relaxation of vascular smooth muscle (21), they also added that nitric oxide is important in brain function and decrease inflammation, but its main function is its involvement in vascular remodeling and angiogenesis meaning the increase capillaries which in turn increase blood flow to the tissues and may also be involved in the pathogenesis of atherosclerosis as it increased blood through blood vessels, also Nitric oxide is of great value in curing hypertension and angina of the heart (22-25).

Data presented in Table (2,3,4) indicated that Vit D3 administration led to an increased concentration of 25 (OH)D to a level sufficient to elevate both growth hormone and IGF(1) that act in inducing an elevation of muscle function due to muscle growth, together with increased nitric oxide (nitrite) concentration and decreased ACE concentration helping in reducing hypertension by vasodilatation of blood vessels, and stimulate Rbc increase in the blood which in turn helping in elevation of health Condition by reducing hypertension and increasing blood O2 blow to the muscles(22,26-29). Also, the decreased pulse rate and blood pressure post Vit D3 ingestion indicated its effect in health and fitness from the discussion above, this can indicate that the hypothesis has been realized

Conclusion

It may be concluded that long term administration of Vitamin D3 may affect positively athletic muscle functions and health and elevation of fitness

Recommendation

It is recommended that Vit D3 levels Should be checked on annual basis as a prophylactic measure for athletes, and to expose to the sun (5-30 minutes) depending on skin pigmentation for fair skin (5 min), and (30 min) for dark skin at close to solar noon several times a week

REFERENCES