ORIGINAL ARTICLE

The Effect of Vitamin D_3 Supplement with Football Training on Glucose, Insulin, Cortisol and ACTH Levels: Vitamin Supplement Study

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ABSTRACT

Background: Vitamin D_3 has an important role in the development of the musculoskeletal system, the protection of bone health and the effective functioning of the neuromuscular systems.

Aim: In this study, it was aimed to investigate the effects of vitamin D_3 supplementation on glucose, insulin, cortisol and ACTH hormone given to young football players during four weeks in addition to training.

Methods: 14 male volunteer athletes participated in the study. They were randomly divided into two groups as the control group (n:7) who continued their football training 5 days a week for four weeks, and the application group that received vitamin D_3 supplements in addition to football training (n:7). Resting blood samples were taken from the athletes participating in the study one day before and one day after the training and reinforcement applications. Glucose, insulin, cortisol and ACTH values were determined in the blood samples taken. Paired Samples t test was applied to determine the changes occurring within the group.

Results: As a result of the analysis, there was no statistically significant difference between the glucose, insulin, cortisol and ACTH pre-test and post-test levels of the control group ($p > 0,05$), while the glucose and insulin levels of the group given vitamin D_3 supplement were found to be significantly different ($p < 0,05$). In the intergroup analysis of the groups in terms of pre-test and post-test values, no significance was found in glucose, insulin, cortisol and ACTH values ($p > 0,05$).

Conclusion: As a result of the research, it was found that vitamin D_3 supplementation applied in addition to football training caused differences in insulin and glucose levels among the biochemical parameters of young football players; It is thought that the use of D_3 together with exercise will produce results that improve public health and athlete performance.

Keywords: Vitamins, exercise, ACTH, cortisol

INTRODUCTION

Vitamin D_3 has an important role in the development of the musculoskeletal system, the protection of bone health and the effective functioning of the neuromuscular systems. Vitamin D_3 deficiency or decrease causes bone demineralization. Vitamin D is described as a steroid hormone rather than a vitamin, since it is stimulated and secreted in any tissue, joins the bloodstream, acts on other tissues, and this effect is regulated by feedback systems[1,2].

This steroid hormone; It regulates calcium and phosphorus metabolism as well as physiological effects on bone, intestine, kidney and parathyroid hormones. It is emphasized that parathyroid glands increase the area of action and contribute to bone mineralization in the regulation of serum calcium levels[3].

Apart from the regulation of calcium and phosphorus mechanism, its active form 1,25-dihydroxyvitamin D_3 plays an active role in the regulation of many genes related to cell differentiation and proliferation via nuclear vitamin receptors (VDR). In this case, it also has a role in cell proliferation, differentiation and apoptosis, the functioning of the immune and hormonal system and other functions related to our body[4]. In addition to healthy skeletal system and development, it has been supported by many studies that vitamin D_3 is important in preventing diseases such as various cancer types, immune and allergic diseases, cardiovascular and infection[5,6]. People provide vitamin D, which is a prohormone, by endogenous synthesis from foods, nutritional supplements and when the skin receives sunlight [7]. Under normal conditions, people can synthesize 90-95% of vitamin D in the skin with the effect of day rays.

All forms of this steroid hormone are bound to vitamin D-binding potein (DBP / transcalciferin) in serum, and very few to albumin. It has been emphasized that hydroxylation is transformed into the active forms 25 (OH) D and 1,25 (OH) 2D by transforming one after another in the liver and kidney [2, 8, 9].

There are many receptors for vitamin D in the skeletal muscle[5]. This vitamin found in skeletal muscle; it plays a key role in regulating calcium transport during muscle functions, producing high-energy phosphate compounds, inorganic phosphate uptake, and protein production. Decrease in vitamin D levels due to age has been associated with decreased muscle strength, decreased physical performance, balance problems, and increased falls in different studies[10]. In recent years, there has been a great interest in the effects of vitamin and mineral supplements on physical performance [11,12,13].

In the light of this information, the changes that vitamin D_3 supplements will cause on biochemical parameters in young male athletes playing football have been the main subject of our research.

MATERIAL & METHODS

Subjects: Before starting the study, a volunteer participation certificate was signed from the participants. A total of 14 healthy male soccer players, aged 20-23, participated in the study voluntarily.

Experiment Design: This study is an experimental design study. A total of 14 male soccer players were randomly divided into two groups. The control group (n: 7) doing football training was divided into two groups as the experimental group (n: 7), who were given vitamin D supplements in addition to football training. Both groups continued their football-specific technical-tactical training five days a week for four weeks. The experimental group was given a vitamin D_3 supplement every day for four weeks on a full stomach at the same time. The groups participating in the study were told not to do movements that would require physical fatigue, except for training. Glucose, insulin, cortisol and ACTH levels were investigated in 5 ml blood taken one day before and one day after the study.

Blood Test Procedure: Venous blood samples in the amount of 5 ml were taken from the athletes in yellow-capped tubes from the right arm between 08: 00-10: 30 in the central laboratory of Fırat University Faculty of Medicine before and one day after the study. Glucose, insulin, cortisol and ACTH levels were analyzed in the blood samples.

Statistical Analysis: SPSS 22.0 program was used for statistical analysis. Data are presented in tabular form as mean and standard deviation. The level of significance was evaluated at the 0.05 level. Paired Samples t test was applied to determine the changes occurring within the group. Independent Sample T test was also performed for the analysis of the pre-test and post-test values of the groups.

RESULTS

The statistical data of the pre and post test values of the football players participating in the study and the vitamin D_3 supplement group are presented in the tables below.

Table 1: Analysis of control group pre-test nd post test values

		Mean	SD.	t	p
GLUCOSE	Pre-test	84,29	11,39	,603	,569
	Post-test	84,00	10,77		
ACTH	Pre-test	29,65	12,40	-,403	,701
	Post-test	29,67	12,44		
INSULIN	Pre-test	11,84	6,000	1,226	,266
	Post-test	11,74	6,115		
CORTISOL	Pre-test	12,59	3,799	,511	,628
	Post-test	12,51	3,585		

Considering the pre-test and post-test analysis of the control group doing football training in Table 1, no statistical significance was found in glucose, insulin, cortisol and ACTH levels (p> 0.05).

In Table 2, a statistical significance was found in favor of the post-test in the glucose and insulin values of the experimental group given vitamin D_3 supplement in addition to football training (p <0,05). Increase in ACTH values in favor of the last test; there was a decrease in cortisol level in favor of the post-test. This change in ACTH and cortisol levels was not found statistically significant (p> 0.05).

Table 2: Analysis of the pretest and posttest values of the vitamin D_3 supplement group

		Mean	SD.	t	p
GLUCOSE	Pre-test	83,57	11,16	-2,583	**,042**
	Post-test	93,00	4,397		
ACTH	Pre-test	25,63	7,031	-,181	,862
	Post-test	26,12	9,891		
INSULIN	Pre-test	8,154	5,070	-3,091	**,021**
	Post-test	10,08	6,210		
CORTISOL	Pre-test	12,43	3,704	,953	,378
	Post-test	10,64	2,847		

p <0.05 Statistical significance level

Table 3: Analysis of the pre-test and post-test values of the groups

		Mean	SD.	t	p
GLUCOSE	Control	83,57	11,16	-,118	,908
	Experiment	84,29	11,39		
ACTH	Control	25,63	7,031	-,746	,470
	Experiment	29,65	12,40		
INSULIN	Control	8,154	5,070	-1,243	,238
	Experiment	11,84	6,000		
CORTISOL	Control	12,43	3,704	-,080	,937
	Experiment	12,59	3,799		

In table 3, when comparing the pre-test and post-test values of the groups, although the levels increased in all values of the experimental group in which vitamin D supplement was applied, no statistical significance was found in the glucose, insulin, ACTH and cortisol levels (p> 0.05).

DISCUSSION

As a result of the analyzes conducted in this study, which investigated the effects of vitamin D_3 supplementation on glucose, insulin, cortisol and ACTH hormone given to young football players for four weeks in addition to training; no statistical significance was found in the intergroup analysis and in the analysis of the pre-test and post-test values of the control group (p> 0.05). A statistically significant difference was found in the glucose and insulin values of the experimental group in favor of the post-test (p <0.05). An increase in ACTH values in favor of the posttest, a decrease in cortisol level in favor of the posttest was detected. This change in ACTH and cortisol levels was not statistically significant (p> 0.05).

It is known that vitamin D_3 has positive effects on many biochemicals, physiological and cardiovascular systems. As it is known its effect on bone health and muscle functions, which should be in the studies conducted, it has also been supported by studies that it reduces the possible risks in inflammation, infectious diseases and some types of cancer[11]. However, considering the development and performance of athletes, one of the important functions of vitamin D is the opinion that it has effects on muscle and bone development and increase in

people. In studies involving athletes, although a daily dose of 20 ng / ml vitamin D taken for bone health under normal conditions is considered sufficient, a dose higher than 32-40 ng / mg is required to strengthen immunity in individuals who do sports and to minimize the inflammation that develops due to exercise it has been shown in studies[14]. In our study, a statistically significant difference was found in the insulin and glucose values of the vitamin D supplement group ($p < 0,05$). It has been emphasized that this significance may have effects on vitamin D levels by affecting insulin resistance and beta cell dysfunction, directly through vitamin D stimulants, and by influencing calcium balance[15]. It has also been emphasized that vitamin D is a hormone that is mainly produced from 7-dehydrocholesterol on the skin with the effect of sunlight, and is responsible for the proper maintenance of the bone development mechanism in the regulation of calcium and phosphorus in blood levels [15].

Looking at the studies conducted on animals, it has been reported that insulin sensitivity decreases when vitamin D is lowered and vitamin D replacement causes an increase in insulin secretion[16]. In addition, studies on humans supplemented with vitamin D supplements have been supported by studies that vitamin D has positive effects on glucose balance, the risk of diabetes is higher in people with vitamin deficiency, and vitamin D supplementation can reduce this risk[17,18]. Vitamin D has been reported to directly induce insulin secretion in pancreatic β cells by affecting highly dependent calcium channels via intracellular calcium or to cooperate with the activation of calcium dependent endopeptitase, which enables the conversion of proinsulin to insulin in β cells. In addition, it is said that it directly enhances the effect of insulin in focal tissues in the periphery by stimulating the expression of the insulin receptor and regulates intracellular fluids processes through insulin through the regulation of calcium storage in the body [19]. There is also information confirming the link between glucose metabolism and vitamin D. These are the existence of a vitamin D receptor (VDR) in the pancreas. Vitamin D shows its effect in focal tissues by binding to VDR, which acts as the transcriptional activator of many genes [20]. Vitamin D deficiency is among the valid reasons for diabetes. In addition, an increased risk of cardiovascular disease has also been associated with vitamin D. It is thought that this high risk may be caused by low vitamin D levels in diseases such as obesity, diabetesmellitus, dyslipidemia, endothelial dysfunction, and hypertension [21].

In our study, changes were observed in the experimental group in favor of the posttest in cortisol and ACTH values; but this change was not statistically significant ($p > 0.05$). Ayuso et al. (2018) emphasized that there was no significant change in cortisol levels in their studies of vitamin D supplements on rowing athletes[22]. ACTH is a hormone that triggers the production of cortisol. It is an important steroid hormone that mediates cortisol, glucose, protein and lipid metabolism secreted by ACTH, suppressing the response to the immune system and keeping blood pressure in balance. In response to stress, the hypothalamus secretes corticotropin-releasing hormone (CRH) and this hormone triggers the pituitary gland to release corticotropin. Corticotropin, on the other hand, releases cortisol hormone from adrenals by stimulating it[23]. Recent studies in experimental animals and humans have indicated that vitamin D may play an effective role in regulating glucose metabolism and preventing the development process of type 1 and type 2 diabetes (DM) [24].

As a result; it is thought that vitamin D affects glucose and insulin values, regulates glucose, protein and lipid mechanisms by stimulating the ACTH mechanism, and may affect the cortisol hormone level, which is important in suppressing the immune response and keeping blood pressure in balance.

CONCLUSION

As a result; it is thought that vitamin D affects glucose and insulin values, regulates glucose, protein and lipid mechanisms by stimulating the ACTH mechanism, and may affect the cortisol hormone level, which is important in suppressing the immune response and keeping blood pressure in balance.

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