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RESEARCH ARTICLE

EVALUATION OF SOME VITAMINS RELATED WITH GLYCEMIC INDEX IN TYPE 2 DIABETES PATIENTS.

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Abstract

Type 2 diabetes is the most common form and is characterized by the failure of cells to recognize and respond toinsulin which is if not treated accurately. this study aims to evaluation of some vitamins related with glycemic index in type 2 diabetes patients.twenty five patients suffering from diabetes mellitus conducted them investigations including some vitamins and biochemical parameters .the result reveled increasing level of FBS,HbA1c and cortisol hormone in diabetic subjects compared with control at *P* value<0.05 .decreasing level of vitamin E and vitamin D3 in diabetic subjects at *P* value <0.05 .

Introduction:-

Diabetes mellitus (DM) is ametabolic disease identify by hyperglycemia resulting from deficiency of insulin , insulin secretion or together (1). Diabetes has occur as one of the most important diseases worldwide, reaching epidemic proportions . Universal estimates predict that the proportion of adult population with diabetes will increase 69% for the year 2030 (2). Hyperglycemia in the procession of diabetes usually leads to the advancement of microvascular complications, and diabetic patients are more prone to atherosclerotic macrovascular disease. These complexity account for premature mortality and most of the social and economic burden in the long term of diabetes (3). Rising evidence suggests that oxidative stress plays a role in the pathogenesis of diabetes mellitus and its complexity (4). Hyperglycemia increases oxidative stress, which participate to the weakness of the major processes that fail during diabetes, insulin action and insulin secretion. In addition, antioxidant mechanisms are reduced in diabetic patients, which may further increase oxidative stress (5, 6). Several studies have addressed the possible contributes of dietary antioxidants, such as vitamins, in ameliorating the diabetic state and inhibited the development of diabetes complications (7).Type 2 diabetes is one of the main noncommunicable chronic diseases and its complications have become a major cause of morbidity and mortality worldwide. It has been estimated that 285 million individuals have diabetes, most of them type 2 diabetes (8).

Insulin resistance and progressive pancreatic β-cell dysfunction are well-established defects in the pathogenesis of type 2 diabetes.(9) Tissue resistance to the action of insulin is believed to be a common antecedent to both type 2 diabetes and atherosclerotic disease.(10-12) Much research has also demonstrated that both insulin resistance and hyperglycemia increase oxidative stress and thus accelerate the atherosclerotic process. Considerable evidence supports the theory that free radicals play an important role in the development of many chronic degenerative diseases of aging, including type 2 diabetes.(13,14) Highly reactive free radicals can oxidize and damage such essential molecules as DNA, proteins, and lipids,6 and accumulation of damaged, oxidized, and dysfunctional peptides is one of the most fundamental manifestation of aging.(13) To guard against oxidative damage caused by free radicals, two major defense mechanisms - the enzymatic (intracellular defense) and the non-enzymatic (intercellular defense) - are found in the human body. The antioxidants such as vitamin E and vitamin C constitute

the primary intercellular defense against free radicals.(15,16) In laboratory research, vitamin C, vitamin E, and other antioxidants have been shown to prevent tissue damage by trapping organic free radicals and/or deactivating excited oxygen molecules, which are byproducts of many metabolic functions.(17)This antioxidant activity may slow or prevent atherosclerotic plaque formation by inhibiting oxidation of low-density lipoprotein cholesterol (LDL) and thus protecting the vascular wall from oxidized LDL and other cytotoxic oxidative products.(18) Vitamin E may also modify platelet activity,(19-21) reduce thrombotic potential,(22) and modify vascular reactivity(23-24) via antioxidant-related modifications in prostaglandin metabolism and nitric oxide production.Vitamin D deficiency and diabetes mellitus are two common conditions in the elderly population. .Vitamin D deficiency is currently a topic of intense interest, and is widely prevalent across all ages, races, geographical regions, and socioeconomic strata. Suboptimal vitamin D status contributes to many conditions, including osteomalacia, osteoporosis, falls, and fractures (25,26). In addition, epidemiologic observations have associated low vitamin D status with an increased risk of non-musculoskeletal diseases, such as cancer (27), multiple sclerosis (28), type 1 diabetes mellitus (29), type 2 diabetes mellitus (30) and cardiovascular disease (31). Vitamin D is a generic name for a group of fat steroids of which the two major forms are vitamin D2 and vitamin D3. Both forms of vitamin D undergo identical metabolism. Vitamin D is obtained from skin irradiation and limited dietary sources. Vitamin D from the skin and diet is metabolized in the liver to 25(OH) D, which has a long life and is the major circulating metabolite and marker of vitamin D status (32).varioushormones , like, cortisol and growth hormone have insulin- repeated effects. During deficiency of glucose in the blood stream, these hormones are secreted to bring back blood glucose levels by stimulating glucose release from the liver and preventing glucose uptake in peripheral tissues. Increasing levels of these hormones can production insulin resistance and hyperglycemia.The effect of cortisol in the glucose and metabolism of lipid is to a large range opposite that of insulin. Hepatic glucose production is increased, while insulin stimulated glucose uptake in muscle and a fat tissue is weaken. High cortisol of endogenous origin can cause insulin resistance and in diabeticpatients, this can lead to a determination of diabetic control (33). Cortisol change glucose level by affecting glucose transporters in peripheral tissues such as fat and skeletal muscle (34).So, cortisol can participate to increase blood glucose levels due to inactive uptake of glucose in the peripheral tissue. Cortisol may play an important role in the development of type 2 diabetes mellitus , it is possible that even little increase in cortisol within the extent of normal, may have a detrimental effect by worsening diabetes and increasing complexity (35).

Materials and method:-

This study was carried out in the Department of Biotechnology, College of Science,University of Baghdad . Twenty five patients who either attended the diabetic clinic or were admitted in the department and suffering from diabetes mellitus.

Specific investigations like fasting blood sugar (FBS),glycatedhaemoglobin (HbA1c).Serum vitamin E (S.VITE),Serum vitamin D(S.VITD3) and Serum Cortisol was carried out in this study.
Samples were collected ,Analysis of the samples was accomplished in the Chemical Laboratory, University of Baghdad ,Collage of Science ,Department of Biotechnology . in the morning from the subjects Blood samples were collected after 16 hours fasting. A syringe and needle was used to collect 5ml of blood sample from the subjects.

Determination of Serum Vitamin E:-
Serum Vitamin E determined by ELISA Kit for Human Vitamin E(VE).Cat.No:E0922Hu.

Determination of Serum Vitamin D:-
Serum Vitamin D determined by ichroma Kit Human Vitamin D No:INS-VD-EN(Rev.00)

TEST PRINCIPLE: The test uses a competitive immune detection method in this method, the target material in the sample bind to the fluorescence (FL)-labeled detection antibody in detection buffer, to form the complex as sample mixture. This complex is loaded to migrate onto the nitrocellulose matrix, where the covalent couple 25(OH)D3 and bovine serum albumin (BSA) is immobilized on a test strip, and interference with the binding of target material and FL-Labeled antibody. If the more target material exists in blood, the less detection antibody is accumulated, resulting in the less fuorescence signal.

Serum Cortisol was determined by competitive immune detection method by ichroma kit. Fasting blood sugar was estimated enzymatically by using glucose oxidase GOD PAP(Kit)(Liquid)GL2624. Glycated hemoglobin (HbA1c) was determined by (StanbioGlycohemoglobin –pre-fil-procedure No.P350)quantitative colorimetric determination of Glycohemoglobin in whole blood .

The data generated was resolved using statistical software SPSS 17.0, was used for analysis of differences between means for two groups. Pearson correlations were proceed to determine associations between different variables. A scatter plot graph was conducted using Microsoft excel 2010.

Results and Discussion:-

A total of twenty-five (25) patients suffering from diabetes mellitus were recruited to the study. In (Table 1) shows the comparison of means of biochemical parameters between type 2 diabetics and control subjects.

Table 1: Comparison of means of biochemical parameters in type 2 diabetic and control subjects

Parameters	Control Subject	Type 2 Diabetic Subject	P-Value
FBS mg/dl	95 ±10	194.12 ±43.90	<0.05
HbA1c %	5.4 ±0.45%	8.4 ±1.87	<0.05
S.VITE mg/dl	1.25 ±0.18	0.60 ±0.16	<0.05
S.VITD3 mg/L	28 ±5.3	17.53 ±4.18	<0.05
S. Cortisolng/ml	8.4 ±2.3	12.02 ±3.2	<0.05

Mean + SEM

This work examined the degree of involvement of some biochemical parameters in the complications of diabetes mellitus. Fasting blood sugar (FBS), glycatedheamoglobin(HbA1c), Serum vitamin E(S.VITE), Serum vitamin D3(S.VITD3) and cortisol hormone were examined. Fasting blood sugar (FBS) , HbA1c and Cortisol was found at significantly higher ($p < 0.05$) concentration in the sera of type 2 diabetics when compared with controls.The value found in this study may be a contributor to the diabetic condition.

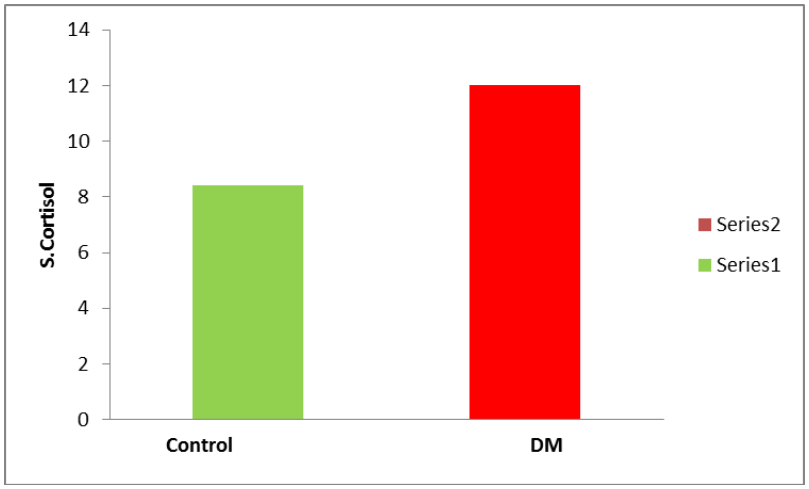

Fig 1: shows concentration of serum cortisol in control and diabetic subject.

Elevated cortisol is associated with increase in hepatic gluconeogenesis and glycogenolysis and consequently with hyperglycemia. Cortisol is a glucocorticoid, the function of which is to ensure that blood glucose level remains elevated. Its role in diabetes mellitus may however be undesirable as it turns to sustain hyperglycemia. This finding points to the need to measure this hormone in diabetics as part of monitoring and control.
Cortisol alters blood glucose by affecting glucose transporters in peripheral tissues such as fat and skeletal muscle (36).

Cortisol has also been linked to obesity (37). It stimulates hepatic triglycerides synthesis (38), increases the number of adipocytes in the visceral depots and stimulates appetite and hence obesity (39). It also induces insulin resistance probably by antagonizing effect of insulin (40).

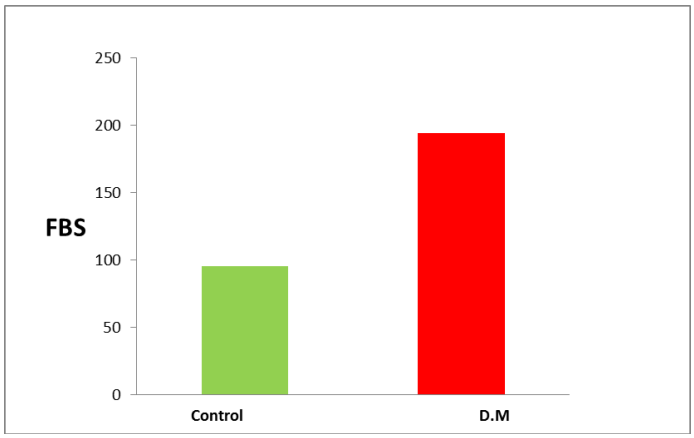

Fig 2: shows concentration of Fasting blood sugar (FBS) in diabetics and control subjects.In our study as clinical trial we showed increased significant in (FBS) in diabetic subjects compared with control.

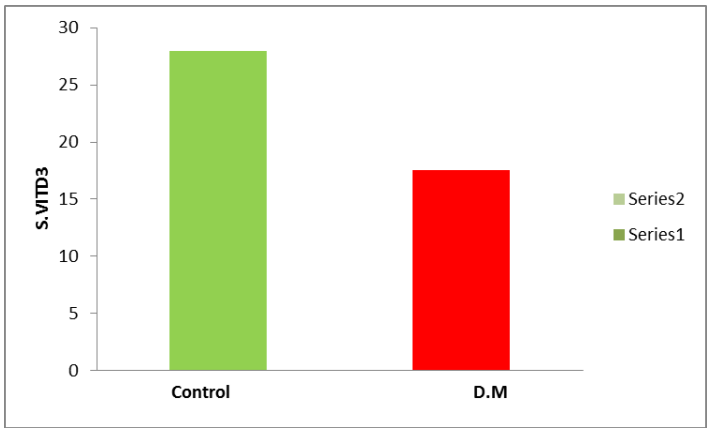

Fig 3: shows concentration of serum vitamin D3 (S.VITD3) in control and diabetics subjects.

Our study also shows vitaminD levels tend to be lower in diabetics. The mean FBSvalue in patients with vitamin D was higherthan in cases with optimal vitamin D levels. The inverserelation between vitamin D levels and FBS in diabeticswas also seen also seen in other studies. In study doneat SreeBalaji Medical College and Hospital, Chrompet,Chennai, on 50 cases of type 2 diabetics the meanvitamin D level was 18.492 with mean FBS value being146.22mg/dl. Chiu et al., 2004 serum 25(OH) D3 ispositively correlated with ISI and negatively correlated with post-prandial glucose concentration (41).

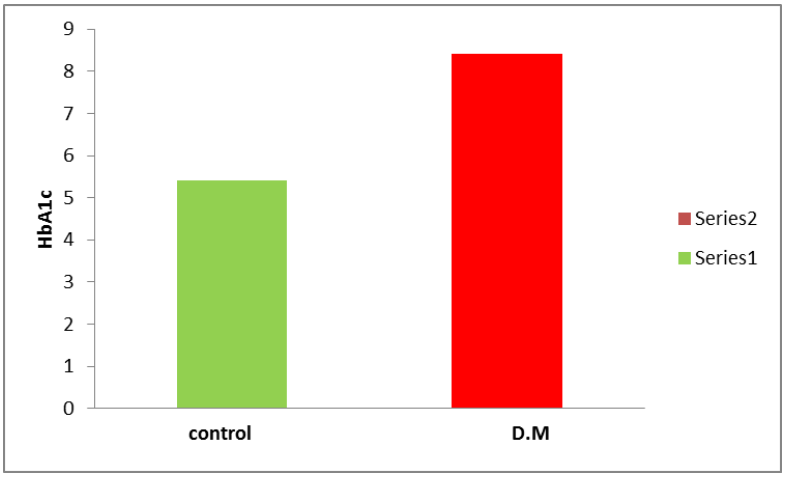

Fig 4: shows value of glycated hemoglobin (HbA1c %) in control and diabetics subjects.

In diabetics the mean HbA1C levels were higher invitamin D deficient patients compared to those withoptimal levels of vitamin D levels. Additionally HbA1clevels were higher in patients with severe vitamin Ddeficiency when compared to subjects with mild tomoderate deficiency. The inverse association betweenvitamin D and HbA1c is similar to other studies. Thestudy conducted by Dalgard and associates on 668Faroese residents, where an increasing concentration ofHbA1c was associated with decreasing levels ofvitamin D levels. This was independent of sex, smokingstatus, body habitus (42).

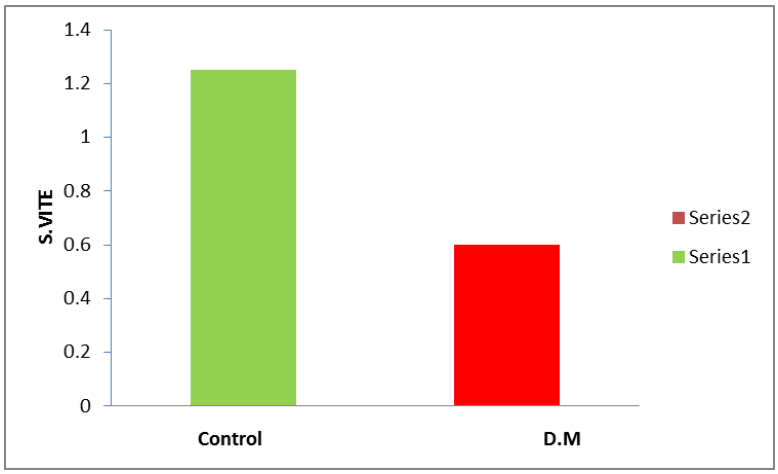

Fig 5: shows concentration of serum vitamin E (S.VITE) in control and diabetics subjects.

Serum vitamin E level was 0.60 mg/dl (SD 0.16) in cases ofdiabetes mellitus while it was 1.25 mg/dl (SD 0.18) incontrol subjects. This decrease in levels of VIT E in cases ofdiabetes mellitus was highly significant (< 0.05). Itsuggests that they have suffered more oxidative stressthan control subjects.

Polidoriet al8 who have estimated VIT E level in 72 type-2 diabetic patients and 75 normal healthy controls. The level of VIT E was 18.6 (SD 1.2) micromol/l in diabeticpatients and was 26.8 micromol/l (SD 1.0) in controlsubjects. When compared, this decrease of VIT E in type-2 diabetic subjects was statistically highly significant (p< 0.001) (43). Our observation also supports this fact.

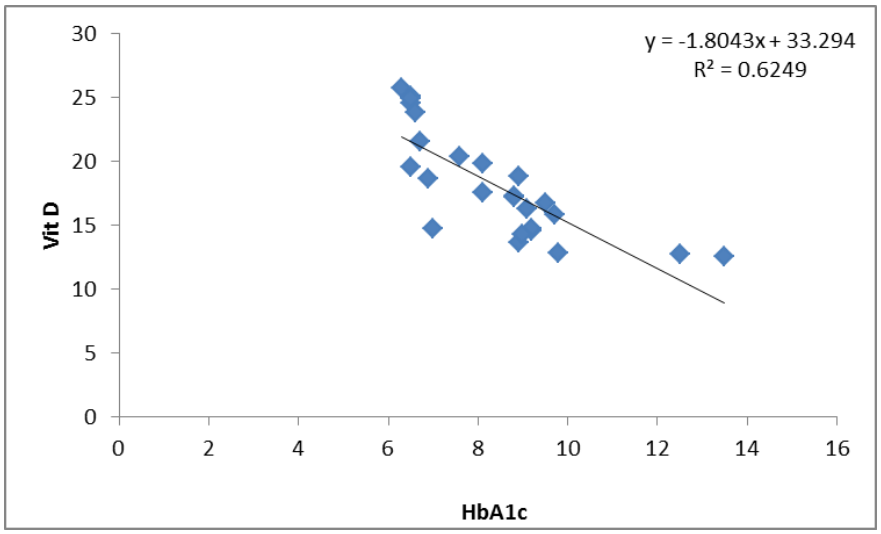

Fig 6: Correlation of level of glycated Hemoglobin (HbA1c) and serum vitamin D (S.VITD) level.

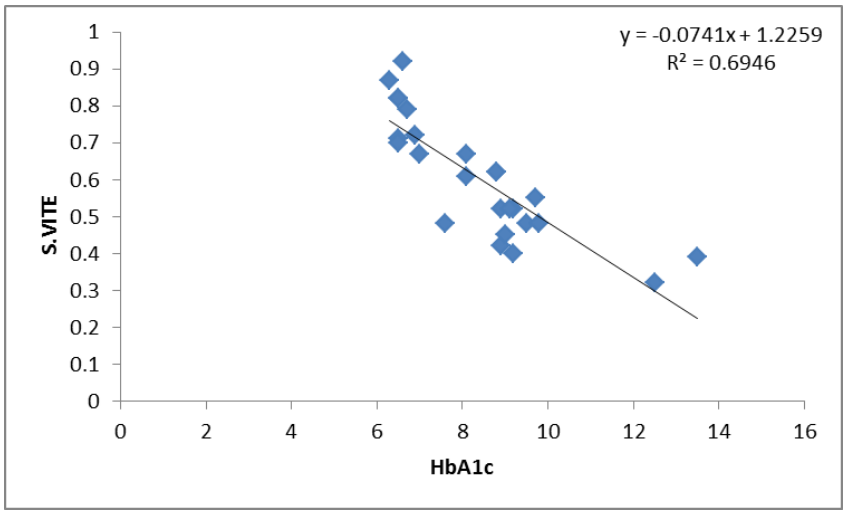

Fig 7: Correlation of level of glycated Hemoglobin (HbA1c) and serum vitamin E (S.VITE) level.

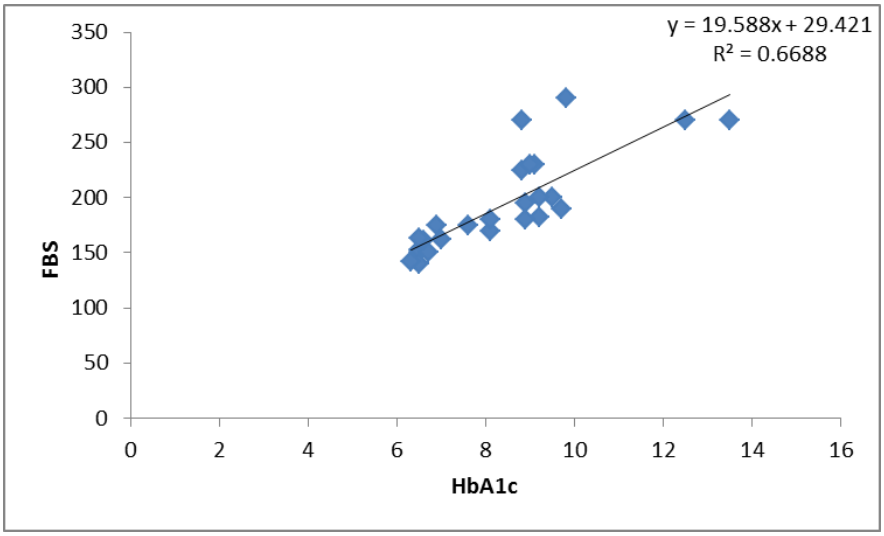

Fig 8: Correlation of level of fasting blood sugar (FBS) and glycated Hemoglobin (HbA1c) level.

Although we found a significant association of both FBS and HbA1c with severe25(OH)D deficiency and vitamin E, similar findings have been reportedinconsistently in previous work. While an inverse association of 25(OH)D and FBS has been observedseveral times in different populations (44,45,46),inverse associations with HbA1c were not detected in younger Americans (45) but detected in older Germans (44). There are several lines of evidence to supportthat vitamin D influences impaired β-cell function,insulin resistance and systematic inflammation (47). It has been demonstrated that vitamin D receptorsexist in many tissues including pancreatic β-cells (48), allowing vitamin D to potentially modulate theinsulin response to elevated blood glucose.

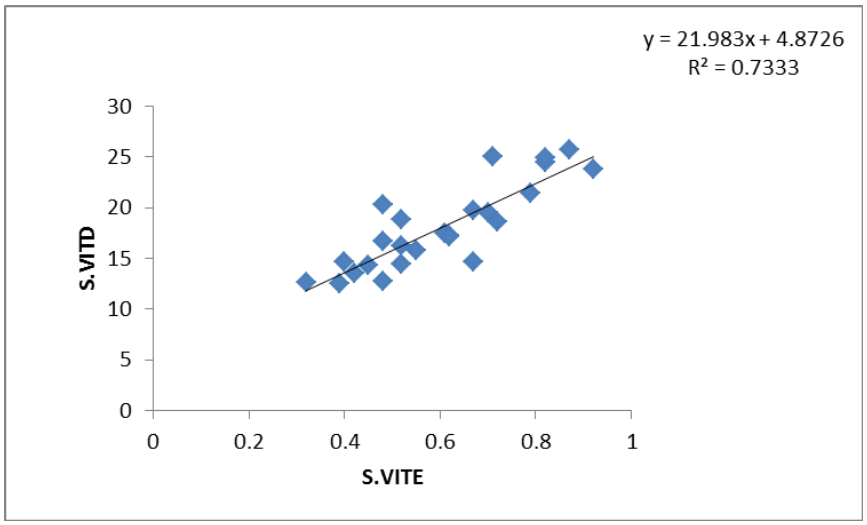

Fig 9: correlation of level of serum vitamin D (S.VITD) with serum vitamin E (S.VITE) level.

In this work we observed positive association between vitamin D and vitamin E level in serum diabetic subjects.

Conclusion:-

This study has found abnormally raised level of serum cortisol, fasting blood sugar (FBS) and glycated hemoglobin (HbA1c) with decreased level of Vitamin E and Vitamin D3 in type 2 diabetics subjects. Vitamin D and Vitamin E deficiency is a risk factor for development of type 2 diabetes mellitus. There might be potential beneficial role of vitamin D and E supplementation and improving glycemic status in type 2 diabetics.

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