Relationship between Depression and Low Vitamin D Level

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Abstract: Introduction: Depression is a devastating disease that adversely affects all aspects of one's existence. Ample evidence suggests that vitamin D has important functions in the human brain and may play a role in depression. Low serum vitamin D is linked to depression, **Aim of the Work**: To investigate the association between serum vitamin D level and depression in a sample of female patients with depressive disorder. **Subjects and Methods:** This study was conducted among a random sample of 50 female depressed patients, their demographic, behavioral, and health-related factors, including age, education, marital state, history of smoking, and participation in physical activity were completed. Weight and height were measured directly and used to calculate body mass index (weight (kg)/height $(m)^2$), their age was ranged from 25-65. They also submitted to **Complete medical history, Complete medical examination, Laboratory investigations:** Assessment of Fasting and postprandial blood sugar, **-** Vitamin D serum level**; serum 25-hydroxyvitamin D (25OHD-Total). Complete Psychiatric interview**; with application of Beck Depression Scale for diagnosis and assessment the severity of depression. **Results** 22% of the sample had mild depression, 44% had moderate depression, and 34% had severe depression, there was statistical significant correlation between severity grading of depression and older age. A direct relation between severity scoring of depression and decreased physical activity, increased body mass index, smoking and hypertension. Low vitamin D level were common in the sample as a whole, with 84% of participants having level in either the deficient range 38 % [25(OH]D< 10 ng/mL], or the insufficient range 46% [25(OH)D < 30 ng/mL]. Mean vitamin D level was 15.2 which was significantly correlated with severity grading of depression. **Conclusion**; Our findings suggest that screening for vitamin D levels in depressed patients — and perhaps screening for depression in people with low vitamin D levels — might be useful.

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1.Introduction

Depression occurs in persons of all ages and backgrounds and both sexes and is a leading cause of disability worldwide **(Bromet *et al.*, 2011).** Depression affects overall health-related quality of life to an equal or greater degree than other chronic medical conditions **(Katon, 2009).** Therefore, identifying risk factors for depression or biomarkers associated with depressive symptoms is of considerable importance.

Depression has increased dramatically over the last century. During this time, exposure to sunlight has also decreased via urbanization, industrialization, and health recommendations, thus, contributing to the reduced exposure of 25-hydroxy vitamin D levels, which is the major circulating form of vitamin D and standard indicator of vitamin D levels. Vitamin D deficiency has become a public epidemic with prevalence reported to range from one third to one half of adults **(Hoogendijk *et al.*, 2008).**

Once more, recent research links low vitamin D levels to increased risk of depression. The results show that elderly people with a serum level lower than 50 nmol/L have a significantly higher risk of depression than their peers with a serum level of 50 nmol/L **(**Milaneschi ***et al.*, 2010).**

Vitamin D receptors are present in the brain, and the central nervous system contains enzymes necessary for vitamin D hydroxylation, making it biologically plausible for vitamin D to be associated with brain activity and thus depression. **(Schneider *et al.*, 2000) (Wilkins, 2006).** Another possible mechanism by which vitamin D may contribute to depression is through parathyroid levels. Low vitamin D levels cause increases in parathyroid hormone (PTH) levels, and hyperparathyroidism is often accompanied by depressive disorders **(Stewart *et al.*, 2009).**

Low vitamin D level is implicated as a risk factor for numerous medical conditions, including autoimmune diseases, vascular disease, infectious diseases, osteoporosis, obesity, diabetes, cardio-vascular disease,

and certain cancers **(Pearce & Cheetham, 2010) (Holick, 2007).** More Recently, low vitamin D level has also been associated with neurologic disorders such as multiple sclerosis, Alzheimer disease, Parkinson disease, and cognitive decline **(Knekt *et al.*, 2010)**. Vitamin D receptors and the vitamin D–activating enzyme 1α–hydroxylase are found in most organ systems of the human body, including the brain. Within the hypothalamus and the dopaminergic neurons of the substantianigra is found a high density of vitamin D receptors as well as the vitamin D–activating enzyme **(Eyles *et al.*, 2005).** Recent evidence suggests that damage to these aspects of the brain is associated with depression, at least in the elderly (**Tsopelas *et al.*, 2011).**

Vitamin D helps the brain produce serotonin, a neurotransmitter critical to emotional health. Vitamin D deficiency can contribute to negative emotions such as depression. Likewise, increased vitamin D consumption elevates mood and promotes a positive outlook. In one double-blind trial, people received 400-800 IU of vitamin D or placebo for five days during late winter. Those taking vitamin D experienced a significant enhancement in positive mood compared to those taking placebo **(Lansdowne & Provost, 1998**). Particularly notable is the unusually rapid response produced by vitamin D supplementation. Individuals felt better after taking vitamin D for only five days.

Individuals living in colder climates where the daylight hours shorten significantly - including those in the Northern United States, Canada, and Northern Europe - are most at risk for vitamin D deficiency and the resulting "winter depression". But clinical research shows that taking extra vitamin D during the winter can improve mood and ward off the winter time blues **(John Cannell, 2011).**

Aim of the Work

To investigate the association between serum vitamin D level and depression in a sample of female patients with depressive disorder.

2.Patients and Methods

A Random sample of 50Saudifemale depressed patients was selected from Out patients AlKhani Neuropsychiatry poly clinics, their age ranged from 25 to 65 years. They were submitted to:

1. Personal History:

Including; age, sex, residence, level of education, occupation, **marital state and smoking habit.**

2. Complete medical history:

History of diabetes mellitus, hypertension, heart disease, hyperlipidemia, History of treatment, Type of treatment, Adherence on treatment, Investigations, History of other medical illness.

3.Complete medical examination.

4. Anthropometric measurements:

Weight was measured to the nearest 0.5 kg and height to the nearest 1.0 cm.

-BMI was calculated as body weight in kg divided by the square of height in meters (kg /m^2).

5. Laboratory investigations:

Fasting and postprandial blood sugar,

Vitamin D level. The blood chemistry was analyzed using automated techniques in Al Borg laboratory. The assay was performed by trained technicians following standardized procedures. The 25(OH)D was chosen as the clinical measure of vitamin D status for patients because of its widespread clinical application, standardized ranges, and testing protocol.

The 25(OH)D (Total) levels was measured on a Chemiluminescence Analyzer which uses a 1-step assay. Vitamin D status is readily assessed by measuring serum 25-hydroxyvitamin D (25OHD-Total) with most authorities defining Deficiency, insufficiency, sufficiency and Toxicity levels as<10.0ng/ml--- ---l0–30ng/ml--30–100 ng/ml and > 100 ng/ml, respectively.

6- Complete Psychiatric interview

A Full psychiatric history, including recent and previous history of depression, and diagnosis using Diagnostic and Statistical Manual of Mental Disorders Fourth Edition, Text Revision(DSM-IV-TR) criteria for diagnosis of depression.

With application of Beck Depression Scale forconfirmation of diagnosis and assessment the severity of depression.

3.Results

Table 1 Sociodemographic factors of the total sample

Item	No.	%
Age		
25-40	20	40
40-65	30	60
Education		
Illiterate	18	36
School	22	44
University	20	40
Marital state		
Single	18	36
Married	25	50
Divorced	7	14
Occupati0n		
Housewife	35	70
Teacher	15	30
Smoker		
Non	42	84
+ve	8	16
Diabetes M		
+ve	10	20
-ve	40	80

Table 2 Sociodemographic factors of the total sample

	N	Minimum	Maximum	Mean	±Std. Deviation
Age	50	20.00	60.00	39.7400	12.19369
Weight	50	40.00	131.00	71.1400	21.67290
Height	50	150.00	170.00	158.3800	4.91100
Vit D	50	5.00	35.00	15.2000	8.75517
BDI	50	4.00	29.00	19.0000	6.04406
BMI	50	16.65	56.27	28.2548	8.34259
Valid N (listwise)	50				

Table 3 Severity of Depression According to Beck Depression Scale

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mild	11	22.0	22.0	22.0
	Moderate	22	44.0	44.0	66.0
	Sever	17	34.0	34.0	100.0
	Total	50	100.0	100.0	

22% of the sample had mild depression, 44% had moderate depression, and 34% had severe depression.

Table 4 Vit.D serum level among the total sample

Vitamin D level	No.	%
Normal Level	**8**	**16**
Low vitamin D level:	**42**	**84**
Deficiency	19	38
Insufficiency	23	46

Low vitamin D level was common in the sample as a whole, with 84% of participants having level in either the deficient range 38 % [25(OH]D < 10 ng/mL], or the insufficient range 46% [25(OH)D < 30 ng/mL].

4.Discussion.

Vitamin D not only is integral to maintaining bone health, but it also plays a role in several other biochemical mechanisms within the human body. Vitamin D receptors are located in bone, skeletal muscle, immune cells, and several body tissues, including the brain, prostate, breast, and colon. The associated cell signaling by vitamin D may account for the mounting evidence that links vitamin D deficiency with an increased risk for a variety of diseases, including cancer, autoimmune disorders, bone disease, cardiovascular disease, and mood disorders **(Grant, 2006).**

Several studies have suggested that there is an association between vitamin D deficiency and many mood disorders, including major depressive disorder, seasonal affective disorder (SAD), premenstrual syndrome (PMS), and other depressive disorders not otherwise specified **(McCann & Ames, 2008).** Vitamin D receptors are present in multiple brain regions associated with depressive disorders, including the prefrontal cortex and hippocampus, **(Eyles *et al.*, 2005)** and cells in many of these regions are capable of metabolizing 25-hydroxyvitamin D to the biologically active metabolite 1,25-dihydroxyvitamin D **(Zehnder *et al.*, 2001).** Animal studies have suggested that vitamin D may increase the synthesis and/or metabolism of neurotransmitters, including dopamine and norepinephrine,

The current study was conducted among a sample of 50female depressed patients, their demographic, behavioral, and health-related factors, including age, education, marital state, history of smoking, and participation in physical activity were completed. Weight and height were measured directly and used to calculate body mass index (weight (kg)/height $(m)^2$), their age was ranged from 25-65 with the mean of39,47 years, their body mass index was ranged from 16.65 to56.27 with the mean of 28.25

They were assessed with Beck Depression Scale for confirmation of diagnosis and assessment of the severity of depression. According to Beck Depression Inventory (B D I); 22% of the sample had mild depression, 44% had moderate depression, and 34% had severe depression, there was statistical significant correlation between severity grading of depression and older age.

Tsopelas (2011) reported that Depression is the most common mental illness in older adults, with

concomitant effects on morbidity, mortality, and quality of life. Depression is a devastating disease that adversely affects all aspects of one's existence, It is a pervasive disorder that afflicts individuals of all ages, cultures and races. Nearly 340 million people worldwide, including 18 million in the United States, suffer from depression **(WHO, 2005).** In 1992, the World Health Organization, World Bank and Harvard University initiated the Global Burden of Disease Study **(Murray and Lopez, 1995)**. A primary impetus of the project was to evaluate the burden of> 100 common diseases, utilizing measurements that integraten on fatal health outcomes; depression was the fourth leading cause of disability in 1990 and was predicted to become the second leading cause of disability by 2020. In developed nations, major depression already was a primary cause of disease burden, exceeding all diseases except ischemic heart disease. The disability conferred by depression has been compared to functional impairment from blindness or paraplegia **(Murray and Lopez, 1996)**.

Emerging epidemiologic results among worldwide populations not limited to patients with diabetes have reported positive links between depression and mortality across a wide spectrum of non cardiovascular causes, including cancer, human immunodeficiency virus, chronic obstructive pulmonary disease, and rheumatoid arthritis **(Fan *et al.*, 2007).** A large population-based study in Norway confirmed that depression was a risk factor for all major disease-related deaths, notjust cardiovascular disease **(Mykletun *et al.*, 2007).**

A direct relation between severity scoring of depression and decreased physical activity, increased body mass index, smoking, hypertension and other factors that may be independently associated with depression was found. Although sociodemographic and psychological risk factors are now well-established, there is mounting interest in the search for modifiable risk factors that simultaneously affect depression and other chronic comorbidity especially in the elderly. Hypertension and body mass index (BMI) are among these modifiable risk factors that are increasingly being discussed **(Ophélia Godin *et al.*,2012).**

The relation between depression and hypertension (or high blood pressure) has been previously investigated, but the results have been heterogeneous, and longitudinal studies of population-based samples are scarce. Some studies found that high blood pressure is a risk factor for depression **(Zimmerman *et al.*, 2009)** whereas others failed to confirm this relation **(Mast *et al.*, 2008).**

Adjusted associations between BMI and depression have been reported in several cross-sectional analyses, showing an increased risk of developing depression in obese or overweight subjects **(Scott *et al.*, 2008).**

All participants completed baseline examinations that included measurement of serum 25-hydroxyvitamin D [25(OH)D] levels,, low vitamin D levels were common in the sample as a whole, with 84% of participants having levels in either the deficient range 38 % [25(OH]D <10 ng/mL], or the insufficient range 46% [25(OH)D <30 ng/mL]. Mean vitamin D level was 15.2which was significantly correlated with severity grading of depression; Lower vitamin D level was associated with more severe depression and higher vitamin D level was not only associated with mild depression but also associated with a decreased risk for current depression with statistical significant correlation between low vit.D and severity grading of depression. Also there was statistical significant correlation and strong associations between low serum level of vitamin D and older age patients. An inverse relation between vitamin D level and body mass index was found with statistical significant correlation. **Heidi *et al.* (**2010), found that Vitamin D was found to have a strong, significant association to incident depression; this was based on More Evidence and findings Link Low Vitamin D to Depression included, first, the incidence of depression was highest among those with very low vitamin D levels. The incidence of depression thereby was lower for higher vitamin D levels. Second, the risk of incident depression was almost 3-fold for those in the very low vitamin D category (≤15 ng/mL) and approximately 2-fold for those with those with low and normal vitamin D levels. Third, vitamin D remained a significant predictor of depression even after adjustment by PTH. However, PTH became non significant after adjustment by vitamin D. Fourth, when vitamin D levels were obtained in the winter months, the associations to depression were greatly enhanced. Lastly, associations of depression to categories of vitamin D were slightly stronger among those who were older (≥65 years).There is a controversy about the relation between low vit D and depression with low Vitamin D a result or a cause, of depression**, Kjærgaard Marie (2012)** said that

Low serum vitamin D is linked to depression, but treating with high doses of the supplement does not appear to ease depressive symptoms. This implies that vitamin D deficiency is the result of depression and not the cause of depression **on the other hand** Brown (2011), reported that Vitamin D "appears to be important for brain health and may be involved in the pathogenesis of depression."

Despite the development of measurements for 25(OH)D more than 30 years ago, only six research studies comparing mood disorders in women and serum 25(OH)D have been published in the literature

in the past 15 years. Although each study has limitations, four of the six studies (each examining a different mood disorder) show a significant association between mood disorders and low vitamin D levels, indicating that some biochemical mechanism may exist between the two variables. These associations warrant further studies, using rigorous methods to examine the influence of vitamin D on specific mood disorders **(Pamela *et al.*, 2008).**

Conclusion

Depression was associated with lower vitamin D levels in participants with current or prior history of depression. The findings suggest that patients with a history of depression could be an important population to target for screening of vitamin D levels. Additional research is needed to determine the nature and direction of the association between vitamin D levels and depression. So screening for vitamin D levels in depressed patients — and perhaps screening for depression in people with low vitamin D levels — might be useful.

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