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Sunshine, Sadness and Seasonality: 25-Hydroxy- vitamin D, and Depressive Symptoms in the United Arab Emirates (UAE)

Key words: depression; seasonality; vitamin D; deficiency; Arab; UAE

Introduction

Deficient 25-Hydroxyvitamin D (VTD) levels have been documented in the case of several chronic physical health morbidities (Barnes *et al*, 2006; Holick *et al*, 2008). Attention is also increasingly focused on vitamin D's role in mental

health problems, notably schizophrenia and mood disorders such as major depressive and seasonal affective disorder (Berk, 2009). An integrative review reported an association between VTD deficiency and a higher incidence of mood disorders among women in four of the six studies reviewed (Murphy & Wagner, 2008). Similarly, when depressed patients are compared with healthy controls, there is a trend for studies to find higher rates of VTD deficiency in the patient groups (Schneider *et al*, 2000).

A B S T R A C T

Several studies have described the prevalence of vitamin D deficiency in Gulf Arab populations and focused on the physical health consequences of VTD deficiency. No work to date on this population has explored the psychological consequences of VTD deficiency or the issue of seasonal variations in deficiency and symptom severity. The aim of this study was to assess seasonal variation in depressive symptoms and 25-Hydroxyvitamin D levels, exploring the relationship between vitamin D deficiency and mood in female university students in the United Arab Emirates. A cross-sectional study design was used to assess seasonal variation in mood, and a correlational analysis to assess the relationship between vitamin D levels and depressive

symptoms. Depressive symptoms were positively correlated with 25 (OH)D levels. Seasonal variation was observed for both depressive symptoms and vitamin D levels, the summer cohort having the highest levels of vitamin D deficiency and reporting greater levels of depressive symptomatology. The results support previous studies that have suggested an association between 25 (OH)D levels and depressive symptoms. The observed seasonal variation supports the idea of a summer time depressive spike in the UAE, probably due to increased heat/sun avoidance rather than seasonal variations in photoperiod. These findings have implications for mental health promotion and prevention of depressive illness.

The capacity to synthesize VTD diminishes with age, and the prevalence of VTD deficiency and its link with mood disorders appear to be particularly pronounced in the elderly (Stumpf & Thomas, 1989). In a study of VTD, depression and cognitive performance in the elderly, 58% of the participants were VTD-deficient (< 20 nM/L). There was also a robust association between low VTD levels and the presence of a mood disorder, and low VTD levels were associated with poorer cognitive performance (Wilkins *et al.*, 2006). Similarly, the cyclical seasonality observed in some mood disorders has given rise to the idea that VTD deficiency, due to the reduced winter time photoperiod, may play an important aetiological role in seasonal affective disorders (Berk *et al.*, 2007). Arguably, in nations with a fairly constant year-round photoperiod, it may be fluctuations in temperature that contribute more to seasonal variation; this we term the ‘sun avoidance hypothesis’.

The study

This study explores 25 (OH)D levels in a convenience sample drawn from an all female undergraduate student population in the UAE. Despite this Arabian Gulf nation’s perennially sunny climate, high levels of VTD deficiency have been widely reported (Dawodu *et al.*, 1998; Saadi *et al.*, 2006; Sedrani *et al.*, 1983). Research in neighbouring nations concurs, with reports of widespread VTD deficiency, particularly among women (Molla *et al.*, 2005; Siddiqui & Kamfar, 2007). The preponderance of VTD deficiency in Gulf women may be attributable to Islamic and cultural mores that advocate modest dress, which can include extensive body covering extending in some cases to veiling of the face and covering of hands and feet (Saadi *et al.*, 2006). Dawodu and colleagues (1998) suggest that the widespread VTD deficiency is explainable because residents tend to avoid exposure to sunlight because of the excessive heat, especially in the summer months. Other proposed contributory factors include the UAE’s high levels of obesity, relatively dark skin pigmentation, and the presence of dust in the atmosphere, all of which may play a role in reducing the skin’s ability to synthesize VTD (Barnes *et al.*, 2006). This is the first study to explore the association between 25 (OH)D levels and depressive symptoms in the Arabian Gulf region, and also the first to explore seasonality in the depressive symptoms and 25 (OH)D levels of UAE citizens.

Method

Participants

Participants were recruited via posters around the university campus; the posters made no mention of depression or

physical health problems associated with VTD. Participants were excluded on the basis of any self-reported chronic illness. The final participants were 197 female undergraduate students at Zayed University in Abu Dhabi. The University is a federal institution of higher education offering degree programmes, with English language as the medium of instruction. All students were Emirati nationals, bilingual to varying degrees in Arabic and English. The participants were recruited in two phases, summer time (October) and winter time (March), 134 participants and 63 participants respectively. The mean ages for summer and winter participants were 21.07 (s.d. 4.61), and 20.30 (s.d. 1.87) respectively; these differences were not statistically significant.

Measures

All questionnaire measures were translated into Arabic and back-translated by PhD-level faculty from the University’s Arabic language department, with additional input from an experienced bilingual consultant psychiatrist. Measures were presented to participants in dual language form, with items in English and Arabic alongside each other. Presentation in dual language form was deemed necessary for the present population, due to known variability in language dominance.

The Beck Depression Inventory –II (BDI-II) (Beck *et al.*, 1996) is a 21-item self-report inventory assessing the severity and intensity of depressive symptoms. Each item reflects either a cognitive, or a somatic-affective symptom of depression; items are rated from 0 to 3, higher scores reflecting heightened symptom severity. Among North American college students and hospital outpatients the BDI-II was found to have high internal consistency, the coefficient alphas being .93 and .92 respectively (Beck *et al.*, 1996). Subsequent studies of the BDI-II’s psychometric properties report favourably on the instrument’s construct, convergent and predictive validity, in various contexts spanning several nations (Al-Musawi, 2001; Osman *et al.*, 2004; Sprinkle *et al.*, 2002).

Analysis of Serum 25 (OH)D was undertaken by obtaining blood samples from all participants in order to analyse serum 25 (OH)D as an indicator of vitamin D status. Measurement of vitamin D levels was performed by the 25 (OH)D assay, a modified high-performance liquid chromatography (HPLC) method. Serum samples were assessed for 25 (OH)D concentrations at Shaykh Khalifa Medical City laboratory in Abu Dhabi.

Procedure

All participants gave informed consent and the study was

approved by Zayed University Human Subjects ethics committee and the ethics committee at Shaykh Khalifa Medical City. Participants were taken to various participating outpatient clinics in Abu Dhabi city. Each assessment was undertaken in groups of approximately 15 over two-week periods in both October and March. Participants completed questionnaires individually, followed by the collection of blood by a qualified phlebotomist on each occasion. Participants were fully debriefed and informed of the blood test results in writing, and follow-up consultations were offered in the case of severe deficiency.

Results

25-Hydroxyvitamin D

Mean vitamin D levels for the whole sample were 24.20 (s.d. = 17.85). Using conservative guidelines for assessing VTD deficiency (Grant, 2009; Sabetta *et al*, 2005), 26.4% of the sample were categorised as severely VTD deficient, <10 n/L. The rate for deficiency (< 20 n/L) was 56.3 %. As predicted, there was seasonal variation, the summer time cohort's VTD levels ($M = 20.93$, s.d. = 14.94) being lower than those of the winter cohort ($M = 31.29$, s.d. = 21.40); these differences were statistically significant $t [89.54] = -3.44$, $p < .01$.

Depressive symptoms

Mean depressive symptom scores on the BDI for the whole sample were 14.90 (s.d. = 9.22), comparable to normative data reported by Beck, Steer and Brown (1996) among North American college women. As predicted, there was seasonal variation in depressive symptom severity, the summer cohort's depression scores ($M = 16.85$, s.d. = 11.25) being higher than those of the winter cohort ($M = 13.98$, s.d. = 7.98); these differences were statistically significant $t [92.38] = -1.82$, $p < .05$.

Correlational analysis

Depressive symptoms and 25-Hydroxyvitamin D levels were negatively correlated; that is, lower VTD levels were associated with higher depressive symptom scores. This relationship was statistically significant $r = -.11$, $p = .05$

Discussion

A high rate of VTD deficiency was found in the present study,

concordant with previous studies undertaken in the region (Dawodu *et al*, 1998; Molla *et al*, 2005; Saadi *et al*, 2006; Sedrani *et al*, 1983; Siddiqui & Kamfar, 2007). The study also found clear evidence of a relationship between depressive symptoms and decreasing levels of vitamin D. Again, this finding is in line with studies from other nations that have also reported this relationship (Berk, 2009; Schneider *et al*, 2000). The present study demonstrated a clear pattern of seasonal variation in line with our 'sun avoidance hypothesis'; vitamin D troughed and depressive symptoms peaked at the time of year when outside temperatures can regularly reach 48 degrees centigrade during the summer months. This pattern of seasonal covariation is further evidence of the relationship between vitamin D and depressive symptoms.

It is not yet possible to determine conclusively the exact nature of this relationship. Depression very often leads to social withdrawal and inactivity; being behaviourally withdrawn is likely to contribute to reduced sun exposure and therefore lower levels of vitamin D. Similarly, vitamin D deficiency may also promote depressive symptoms either at neurochemical level, or as a result of an individual 'psychologising', providing a psychological explanation for the insidious somatic complaints often associated with VTD deficiency. The two issues, depressive symptoms and VTD deficiency, may actually be mutually exacerbatory.

Our findings have obvious implications for public health initiatives aimed at preventing VTD deficiency and depressive illness in the region. First, the timing of messages on health promotion or disease prevention in this area should be informed by the clear pattern of seasonal variation identified in the study. Second, promoting awareness of the relationship between VTD deficiency and depression may be an incentive for people to adopt less sun-avoidant attitudes, or at least seek VTD assessments and if necessary appropriate supplementation.

The findings have several very important limitations. The study was correlational, so all relationships should be considered statistical rather than causal or temporal. Our study relied on university participants, so its generalisability is limited. However in the UAE 50% of citizens are under the age of 25, so a focus on young people is warranted. Our focus on females is also a limiting factor for generalisability, but again previous research in the region suggests that females are at particular risk, for socio-cultural reasons.

Prospective studies involving VTD supplementation are required to explore more fully the causal relationship between VTD deficiency and depressive symptoms. VTD supplementation and behavioural changes to promote adequate sun exposure may reduce the risk of depressive illness, and would certainly promote health in general.

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