Prevalence of Hypovitaminosis D among ENT Patients in Nigeria – A Multi-center, Multi-regional study

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Original Article

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ABSTRACT

Objective: Vitamin D are fat-soluble hormones with various biological effects in the body. Exposure to Sunlight remains the primary determinant of vitamin D status in humans. Despite abundant sunshine in northern Nigeria, high prevalence of vitamin D deficiency has been reported. Hence, this study aimed to determine the prevalence of vitamin D deficiency among patients attending ENT clinics in Nigeria.

Patients and Methods: A multi-centre, case-control study carried out among ENT patients attending selected tertiary hospitals in northern Nigeria and healthy controls. The study locations and participants were selected using a multi-stage sampling technique. Consecutive consenting patients attending ENT clinics responded to interviewer-administered questionnaires. Serum vitamin D was determined using Calbiotech 25(OH) vitamin D ELISA kit.

Results: Age range of the 198 participants was 2-70 years. Median ages was 31.0 and 31.5 years for subjects and controls respectively. Modal age group was 31-40 years. There were 62.1% female participants with Male to Female ratio of 1:1.6. Prevalence of Hypovitaminosis D was higher among subjects than controls. (*p=0.034*) More females had deficient (87.5%) and insufficient (73.1%) levels of vitamin D compared with their male counterparts (12.5%) and (26.9%) respectively. (*p= 0.009*) Subjects with dark skin colour had lower mean vitamin D level (34.8 versus 39.8nmol/L). (*p=0.006*).

Conclusion: Patients attending general Otorhinolaryngology clinics in northern Nigeria had low vitamin D levels and its supplementation may go a long way in optimizing their primary condition. Female gender and dark skin colour were important factors that contribute to low vitamin D level. Vitamin D supplements may be useful as prophylactics and adjunct treatment for common otorhinolaryngological conditions.

Key Words: Case-Control studies, Nigeria, tertiary care centres, vitamin D.

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INTRODUCTION

There are two sources of Vitamin D in humans: skin exposure to UVB rays (Vitamin D3) and dietary (Vitamin D_2) intake. Sunlight exposure remains the primary determinant of vitamin D status while dietary

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sources include fish oil, liver, egg yolk etc.[1,2] In the absence of adequate sun exposure, at least 800–1000 IU (20–25 mg) vitamin D per day may be required in form of suppliments.[1] Serum 25[OH]D is the best indicator of overall vitamin D status because its measurement reflects total vitamin D from dietary intake and sun exposure, as well as the conversion of vitamin D from adipose stores in the liver.[3, 4]

Causes of vitamin D deficiency include inadequate sunlight exposure, poor dietary intake, liver and kidney diseases and anticonvulsant drugs.[5] Low levels of vitamin D have been implicated in malignancy, neurologic and musculoskeletal disorders as well as chronic infection.[1]

There is a high burden of otolaryngologic diseases worldwide and those that contribute to this global burden include otitis media, head and neck cancers and oral disorders.[13] Similarly, the burden of E.N.T diseases in Nigeria, the most populous black nation in the world is enormous and this continues to increase with the geometric growth in population. However, otolaryngological manpower, facilities and funding remain generally inadequate in the face of other contending public health challenges like malaria, malnutrition and maternal and child health bedeviling African countries, Nigeria inclusive. In such circumstances, the importance of prevention as a cost effective approach to otolaryngologic health care cannot be overemphasized. Hence, we studied serum vitamin D levels in patients presenting with otorhinolaryngological diseases in Nigeria.

PATIENTS AND METHODS:

This was a multicentre, case-control study among participants drawn from three geopolitical zones of Nigeria: North-central, North-west and North-East. Study locations were selected by multistage sampling of the geopolitical zones and tertiary hospitals in the country. Ethical approval was obtained from the Ethics and Research Committee of each of the three selected hospitals.

Written informed consent was obtained from participants after information about the study was given. **Excluded were patients on antipsychotics and those on vitamin D supplements**. Participants responded to interviewer-administered questionnaire. Information collected include; biodata, presenting symptoms and diagnoses. Anthropometric parameters (height, weight and BMI) were measured followed by ENT, Head and Neck examinations. Venepuncture was carried out in a well-lit cubicle. Two milliliters of blood was drawn and dispensed into a plain bottle for vitamin D assay. The serum was collected and stored at -20°C. Biochemical analysis was done in batches of fifty. Vitamin D was measured using Calbiotech 25(OH) vitamin D ELISA kit (Calbiotech Inc, California, United States). Reference interval was 3.125 nmol/L to 375 nmol/L. Case definition was based on laboratory classification of serum vitamin D levels; < 25 nmol/L as deficient, 25 – 75 nmol/L as insufficient, >75 – 250nmol/L as sufficient and > 250nmol/L as intoxication.[3,6,7] Deficient and insufficient levels were grouped as "Low level" while sufficient and intoxication were referred to as 'normal' and 'high' levels respectively. **A hundred and ninety eight age, sex and socio-economically matched healthy controls were drawn from the same community**.

Data was analysed using a 2011 IBM SPSS (statistical package for social sciences) for windows, version 20.0; Armonk, NY. Categorical variables were explored using Chai square or Fischer's exact test as appropriate. Mean 25 (OH)D concentrations of subjects and controls were compared using Student t-test. Data were presented as tables, utilizing descriptive statistics of frequency and percentages and Microsoft Excel™ software for graphical representations. Level of statistical significance was set at *p-value* equal to or less than 0.05 at 95% confidence level.

RESULTS:

Age of the Three Hundred and Ninety Six (396) participants ranged from 2-70 years. Median ages were 31.0 and 31.5 years for the subjects and controls respectively. Modal age group of participants was 31-40 years. Seventy five (37.9%) were males while 123 (62.1%) were females. Male to female ratio was 1:1.6. Majority belongs to low socio-economic class (65.7%). One hundred and forty five subjects (73.2%) had dark skin colour. (Table 1)

The prevalence of vitamin D deficiency in the subjects was 4.0% against 3.0% in the controls. Prevalence of insufficiency was 39.4% and 27.8% in the subjects and controls respectively. (Table 2)

More females had deficient (87.5%) and insufficient (73.1%) levels of vitamin D (*p-value= 0.009*). (Table 3)

Subjects with dark skin colour had lower mean vitamin D level (34.8). (*p=0.006*) (Table 4)

More subjects had lower levels of serum vitamin D compared to the controls (*p=0.034*). (Table 5).

Table 1: Socio-demographic Characteristics of the Participants

Variables	Subjects N (198) n (%)	Controls N (198) n (%)	X^2	*p-value*
Age Groups			6.157	0.522
≤ 10	31(15.7)	26 (13.1)		
11 – 20	28 (14.1)	25 (12.6)		
21 – 30	39 (19.7)	45 (27.7)		
31 – 40	42 (21.2)	42 (21.2)		
41 – 50	22 (11.1)	32 (16.2)		
51 – 60	21 (10.6)	11 (5.6)		
61 – 70	13 (6.6)	15 (7.6)		
> 70	2 (1.0)	2 (1.5)		
Mean Age ± SD	31.4 ±18.4	32.8±17.1		
Median Age	31.0	31.5		
Mode	22.0	40.0		
Gender			0.381	0.537
Male	75 (37.9)	81 (40.9)		
Female	123 (62.1)	117(59.1)		
Socio-economic status				
Middle	68 (34.3)	109 (55.1)		
Low	130 (65.7)	89 (44.9)		
Skin Colour				0.082
Dark	145 (73.2)	129(65.2)		
Fair	53 (26.8)	69 (34.8)		

Table 2: Vitamin D status of the participants

Vitamin D status	Subjects N (198) n (%)	Controls N(198) n (%)	*P-value*
Deficient	8 (4.0)	6 (3.0)	
Insufficient	78 (39.4)	55 (27.8)	
Sufficient	111 (56.1)	136 (68.7)	
Intoxication	1 (0.5)	1 (0.5)	
			0.079

Table 3: Vitamin D status of male and female subjects

Gender/Vitamin D status	Deficient n (%)	Insufficient n (%)	Sufficient n (%)	Intoxication n (%)	X^2	*P value*
Males	1 (1.3)	21(28.0)	52 (69.3)	1(1.3)		
Females	7 (5.7)	57 (46.3)	59(48.0)	0(0.0)		
					11.602	0.009

Table 4: Mean Levels of Vitamin D and Skin Colours of Participants

Vitamin D levels	Dark	Fairs	t	*P value*
Mean (nmol/L)	34.8	39.8	-2.752	0.006
S D	17.1	15.5		
Range	103.8	99.8		

Table 5: Comparison of Vitamin D Status of the Participants

Vitamin D status	Subjects N (198) n (%)	Controls N(198) n (%)	X^2	*P value*
Low	86 (43.4)	61 (30.8)		
Normal	111 (56.1)	136 (68.7)		
High	1 (0.5)	1 (0.5)	6.782	0.034

DISCUSSION

The northern part of Nigeria has a typical hot semi-arid climate. Apart from the rainy season that often lasts for 3 to 4 months (June-September), the temperature in the rest of the year could be as high as 40 degree Celsius (104 degree Fahrenheit).[8] However, even though UVB is the principal source of vitamin D, the bright scorching sunlight may itself destroy vitamin D produced in the skin.[5]

The prevalence of vitamin D deficiency varies according to the settings of study, case definition and normal limits adopted for the study. This is so because there is no absolute agreement as to what a normal range for 25(OH)D should be. From this study, the prevalence of vitamin D deficiency and insufficiency in ENT patients were 4% and 39.4% respectively. Overall, from this study, it was found that more participants with ENT diseases had low levels of vitamin D compared to the controls. (*p=0.034*) Rockell *et al*. reported a prevalence of 84% using 80 nmol/L as the lower limit of normal.[9] While a prevalence of 58% and 100% were reported when 25(OH)D levels of 50 nmol/L and 80 nmol/L respectively were adopted as the cutoff in another study.[10] Similarly, a study that adopted ≤75nmol/L as cutoff, as done in this study, reported a prevalence of 96.51%.[5] All the above quoted studies were carried out among non-blacks (New Zealand and India respectively). However, in a study conducted in Lagos Nigeria to assess serum vitamin D of pregnant women, the prevalence of Vitamin D deficiency (<20ng/mL) was 4.8% while insufficiency (21–29 ng/mL) was 28.3%.[11] Note that to convert to ng/mL, the 25(OH)D level reported in nmol/L is multiplied by a factor of 0.4. In this regard, the reported prevalence was close to our findings probably because the participants are similar in terms of race and culture. This finding could be partly because of the damaging effect of the high intensity sunlight our subjects are exposed to in the northern part of Nigeria.

Similarly, there were more females with deficient (87.5%) and insufficient (73.1%) levels of vitamin D in this study (*p-value= 0.009*). Previous studies have reported hypovitaminosis D in females in Nigeria especially those from the northern parts of the country and this has been attributed to use of purdah (veils) as most of them are regularly covered in thick dark dresses and veils.[12] Similarly, a study conducted in Kano State, Nigeria found low serum vitamin D levels in women and submitted this could be because of cultural reasons which prevent them from staying outdoors or covering their body when outside.[13] However, findings from another study showed no significant variation in the prevalence of serum vitamin D with gender.[9]

From this study, dark skin participants had lower mean vitamin D levels (34.8nmol/L) compared to the fair skinned (39.8nmol/L). Previous studies reported that darker pigmentation among other factors limit the penetration of UVB.[5] This could explain why participants with dark skin in this study had low vitamin D levels.

Vitamin D deficiency increases the risk of upper respiratory tract infections (URTI). This is because vitamin D is responsible for the production of both cathelicidin and defensin β2, which have an important role in the protection of the upper and lower respiratory tracts.[14] For the same reason, vitamin D supplementation decreases the incidence of respiratory tract infection in adults.[15] Aside from pathologic bacteria like pneumococci, meningococci and streptococci, there are about 200 viruses which can cause common cold and acute otitis media. Most of these pathogens are sensitive to the anti-microbials, cathelicidin and defensin.[16-19] Although, a level below 50nmol/L might be appropriate for bone health, there is a body of evidence suggesting that the optimal vitamin D level, particularly with respect to cardiovascular health, infectious disease and cancer prevention might be up to 80 nmol/L and even higher.[20-22]

Because a broad range of otolaryngological conditions was seen, this made it difficult to check serum vitamin D levels in each clinical condition. A future study to determine the serum vitamin D in respective otolaryngological conditions would be worthwhile.

CONCLUSION

Patients attending Otorhinolaryngology clinics in northern Nigeria had Hypovitaminosis D as dark skin colour and female gender constituted factors associated

with the condition in this study. Future studies should focus on determining relationship between individual ENT disease entity and hypovitaminosis D.

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CONFLICT OF INTEREST

There are no conflicts of interest.

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