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Assessment of Vitamin D Status and Response to Vitamin D3 in Obese and Non-Obese Children and Adults

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Abstract: *Due to its great prevalence and harmful consequences on health, obesity appears to be a serious problem in today's society. Studies have connected obesity with lower blood calcifediol concentrations. Examining the blood vitamin D levels among overweight and non-obese adults as well as adolescents was the goal of the current study, as well as compare how they responded to the similar oral vitamin D3 treatment. The blood vitamin D levels of a small number of obese children and adults and some obese individuals were compared in a non-randomized clinical study. 1 pearl of vitamin D3 (50 000 Iu) was given to those with a blood vitamin D status of thirty milligrams per milliliter (74 occurrences) every week for six weeks. Two weeks after starting therapy, serum vitamin D levels were tested once again. At baseline, individuals with obesity had a frequency of low Vit D level of 42/44 (95.5%) compared to 31/46 (66.6%) of patients with non-obesity (p 0.002). The aforementioned percentages were reduced to 24/43 (55.8%) and 1/30 (3.3%), respectively, following therapy for these individuals (p 0.001). Our investigation showed that patients, especially those who were obese, frequently had vitamin D deficiencies. Moreover, the obese group shows a modest therapeutic response.*

Key Words: Vitamin D, Vitamin D3, Obese, Children, Adult

Introduction

Recent research has indicated a significant frequency of hypovitaminosis D and associated negative repercussions (Netto et al., 2021). According to estimates, 1 billion individuals worldwide have vitamin D deficiencies or insufficiencies (Al Anouti et al., 2022; Charoenngam et al., 2019). Moreover, Middle Eastern nations are thought to have a far greater frequency of low vitamin D levels (Lips et al., 2019). It may be the consequence of several things,

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such cultural clothing rules, spending less time outside, and consuming less vitamin D (Horton-French et al., 2019; Hajizadeh et al., 2019).

Vitamin D has a substantial impact on a child's bone health (Kwda et al., 2019; Taylor, 2020). Rickets syndrome, osteoporosis, bone loss, and osteomalacia are all musculoskeletal issues brought on by its absence, as is a secondary hyperparathyroidism (Cianferotti, 2022; Trombetti et al., 2022). Recently, low vitamin D levels have been linked to a range of adult health issues, including coronary artery disease (Kim & Jeong, 2019), hypertension (Latic & Erben, 2020), infections (Ali, 2020), immunological illnesses, and common malignancies (Cyprian et al., 2019).

The World Health Organization (WHO) claims that due to its rising frequency, overweight [BMI 94th percentile] has lately turned into an epidemic issue. Previous research has shown a link between obesity and lower blood levels of 25(OH) D. Additionally, it has been suggested to provide larger doses (2-3 times greater) of vitamin D3 to obese children who are vitamin D inadequate.

Materials and Methods

Study Subjects

Patients with and without obesity were included in the study's participant pool. While non-obese patients were drawn to general and immunization clinics, those with obesity were often selected from endocrine clinics. It is crucial to keep in mind that individuals who are fat are often sent to endocrine clinics. Use of calciferol, vitamin supplements, antidepressants, or glucocorticoids that are systemic were among the excluded criteria, as well as the existence of chronic illnesses, endocrine conditions that lead to obesity (like Cushing syndrome as well as hypothyroidism), as well as BMI between the 85th and 95th percentiles (overweight) for both sexes. The research distinguishes among the obese and non-obese groups as a consequence.

Study Design

A non-randomized experiment was used to examine the prevalence of low Vit D level and the treatment response to equal oral cholecalciferole dosages in over weight vs. normal weight people. A stadiometer and a Seca balance were used to measure each person's BMI. overweight participants (BMI 94th percentile) and normal weight subjects (BMI calculated based on age as well as sex) were divided into two groups. (5th BMI 85th percentile).

Based on Pathak's classification, participants' skin tones were classified as type 3 or type 4 respectively. The Tanner criteria were used to determine their pubertal maturity. Before and two weeks after therapy, Serum 25(OH)D, calcium, phosphorus, alkaline phosphate, and parathyroid hormone (PTH) levels were measured.

Individuals with appropriate calciferole levels exited the study and did not receive the treatment when the first blood sample was taken during 9 and 12 am. However, those with blood vitamin D levels under 30 nanograms per milliliter received treatment with single cholecalciferol pearl (50 000 IU) every week for a total of six weeks. Every week, families get a reminder about their loved ones' therapy. Patients who did not respond well enough to the first round of treatment received the same dosage again.

Biochemical Measurements

Immuno Diagnostic Systems Kits used the radioimmunoassay technique to quantify serum 25(OH)D. At a concentration of 15.6 ng/ml, the intra-assay and inter-assay coefficients of variation were 5.3% and 4.6%, respectively. The Cobas e411 machine was used to measure PTH. The coefficients of variation for the intra- and inter-assays were 5% and 8%, respectively.

Statistical Analysis

The statistical analysis's results, which were produced using SPSS, were presented as Mean 6 SD. For ongoing results, an independent t-test was used to compare the group means, and for categorical outcomes, Fisher's exact and Chi-square was utilized. The Pearson correlation was used to assess the relationship among the blood vit

D level at start and post treatment and BMI. Multiple linear regressions was used to examine the impact of independent factors (BMI, age category, and sexuality) on a change in blood vitamin D level. The statistical analysis determined that p 0.05 was the significant threshold.

Results

Clinical Characteristics

Patients with and without obesity were recruited in the research. In the obese group, both the mean weight and BMI were considerably greater (p 0.001). The difference in mean height between obese and non-obese people can be attributed to the latter group's older average age. The vast majority of participants had type 3 skin and were stage I and II tanners. The cohorts' mean dietary intakes of calcium and vitamin D, which were below the advised dietary requirements, were not substantially different from one another. It should be highlighted that we disregarded the effect of short-term sun exposure at unsuitable times of day on serum because it occurred in all subjects.

Baseline Laboratory Data

In the outset, the obese group had considerably lower baseline levels of blood vit Ddespite having significantly higher baseline levels of alkaline phosphatase and PTH (p 0.05). At baseline, there were no notable changes in calcium and phosphorus levels between the obese and non-obese groups, and there was no sign of rickets. (95.6%) obese people had hypovitaminosis D, compared to just (66.7%) non-obese people (p 0.001).

In younger obese individuals, the prevalence of hypovitaminosis D was determined at 75%, compared to 97.6% in older obese patients (p 0.05). Between the two age groups, there was not a significant disparity in the proportion of non-obese people with low vitamin D levels (63.6% vs. 69.6%, p 14 0.67).

When the prevalence of low calciferol levels was compared by gender (one hundred percent in obese females vs. 92.6% in obese men, p 0.79; and 71.9% in non-obese females vs. 62.8% in non-obese males, p 0.53), there was no statistically significant difference between the obese and non-obesity groups.

Table 1

Baseline Laboratory Results

laboratory Results	Overweight	Normal Weight	*P*Value
Ca (miligram/dL)	10.0 0.5	10 0.5	0.45
P (miligram /dL)	4 0.5	5 0.5	0.24
Parathyroid harmone (picogram/mL)	35 14.2	27.1 10	0.03
vit D(nanogram/mL)	12 5	22.5 15	<0.001
ALP (IU/l)	701 133	580 125	<0.002

Post-therapy Laboratory Data

All patients, obese and not, received 300 000 IU, of six weeks of oral cholecalciferol treatment. In the obese group, the blood vit Dlevel was significantly lower. (p 0.001). further determined at 32 nanogram/mL in 8 cases of obesity. In accordance to a tiny number of patients who did not react to the first round of therapy, the comparative analysis was difficult. (particularly in the non-obese group). It should be emphasised that 100% of the obese participants who did not react to the second round of treatment and 88% of the obese patients who did respond both had BMIs over the 99th percentile for their age and sex. Ultimately, using the third therapy cycle, we were able to effectively treat the remaining seven instances.

Table 2

Post-therapy Laboratory Result

Laboratory Result	Overweight	Normal Weight	*P* Value
Ca (miligram/dL)	8.7 0.5	9.5 0.7	0.52
P (miligram/dL)	5.5 0.9	5.6 0.8	0.03
Parathyroid Hormone (picogram/mL)	32.7 19.5	20 13.3	0.02
Vit D(nanogram/mL)	44.7 35.2	91 39	<0.001
ALP (IU/l)	701 133.9	576 125	<0.001

Correlations

Serum vitamin D levels showed considerable -tive associations with Body Mass Index both at baseline and after therapy. (ro.39, p 0.001 and ro.61, *p* 0.003, respectively). The mean blood vitamin D level (before and after treatment) changed by 34.8 Nanogram/mL less on average in the obese group than in the non-obese group, according to multiple linear regression analysis . The average blood vit D level changed by 23 nanogram/mL more in kids under the age of six than in older people. It ought to be noted that there were two age divisions for the courses, to take into account the impact of the cultural dress code shift brought on by the school uniform for students of both sexes and the hijab for female students. Thus, the only body parts exposed to the light in participants older than 6 are the face and hands.

Table 3

Effects of age, gender, and obesity on the change in 25 (OH) D statuses

Variables	Ba	SD	Beta	Significance
Constant	53.5	12	–	0
Obesity	-40	9.5	-0.45	0
Age group	-20	11	-0.5	0.049
Gender	-0.88	8.5	-0.1	0.926

Discussion

We examined patients' vitamin D levels and how well they reacted to receiving 50000 IU of vitamin D3 once a week for six weeks in this non-randomized clinical investigation. Hypo-vitaminosis D was seen in 66.7% of patients who were not obese compared to 95.6% of obese individuals. Due to this, it was discovered that the incidence of low blood calciferol levels was much higher in the overweight group than in the normal weight group, not depending upon food consumption.

Researchers have repeatedly shown a link between overweight and a decline in blood vitamin D levels (Bhatt et al., 2020; Hajhashemy et al., 2021). The increasing prevalence of obesity across the globe makes this conclusion seem more important than it previously was. Additionally, we discovered that there were substantial differences between the groups in terms of the therapeutic response to oral vitamin D3. As was said before, after treatment, the proportion of children with hypovitaminosis D rose from 3.3% in children who were not obese to 55.8% in children who were obese. It is also important to highlight that overweight individuals had a lower mean blood vitamin D level change.

It should be noted that in our research, the average daily vitamin D consumption for all individuals (53.8 IU for overweight participants and 52.2 IU for people who were not fat) was much lower than the amounts recommended. This might be a major contributing factor to the

prevalent calciferol deficiency in our society. The negative correlation between BMI and blood vit D levels at baseline and post-treatment (r = 0.39, p 0.001 and 0.55, p 0.001, respectively) was another interesting observation. Similar findings from earlier studies were obtained (Jiang et al., 2021; Islam et al., 2022).

In order to improve the research by aiming to exclude confounding variables like gender and season, we designed it as a clinical trial. We used an approved survey filled out by the respondents' families to evaluate the subjects' daily calciferol intake as well as the quantity and quality of their exposure to sunlight. Additionally, vitamin D3 was used at the recommended dose for treatment. The limited sample size and inability to eliminate the age-related confounding factor, however, limit our ability to conduct a thorough study. It was difficult to determine the relatives' cooperation even though we consistently reminded them of their loved ones' treatment.

Conclusion

The study founded that obese individuals responded considerably less favourably to a conventional dosage of vitamin D3 than did non-obese patients. To get the right dosage of vitamin D3 treatment for obese individuals, it would be advantageous for future research to include more participants. Also, we advise evaluating all obese individuals for vitamin D insufficiency so that it may be treated before any negative consequences appear.

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