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RESEARCH ARTICLE

CORRELATION BETWEEN SERUM VITAMIN D LEVEL AND PULMONARY FUNCTION (FEV1) IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE(COPD).

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Key words:-
Chronic obstructive pulmonary disease, Vitamin D, Pulmonary function tests, Forced expiratory volume in first second (FEV1).

Abstract

Background:- Evidence suggests that vitamin D has role apart from its classic action on bone and calcium homeostasis. Vitamin D deficiency associated with pulmonary function deterioration.

Aims: The present study was done with the following aims & objectives. 1. To measure the serum 25-Hydroxy vitamin D status in patient with COPD with acute exacerbation and compare it with stable COPD state. 2. To assess the relationship between serum 25-Hydroxy vitamin D in patients with stable COPD and Forced expiratory volume in 1st second (FEV1) in patients with COPD.

Methods:- From November 2013 to September 2015 fourtysix consecutive patients with COPD presented to our outdoor and indoor of Pulmonary medicine VSS Medical College entered to the study.Serum 25-OHD was assessed by Electrochemolminescence Immunoassay method and postbrochodilator forced expiratory volume in 1s (FEV1) was measured in all patients. Serum vitamin D was categorized as deficient (< 20 ng/ml),Insufficient (≥20 ng/ml to < 30ng/ml) and Sufficient (≥ 30 ng/ml). The mean values of FEV1 for each class of serum 25-OHD were determined and compaired.

Results:- The mean age of patients was 65.5±5.42 years. The mean serum 25-OHD level in A/E of COPD state was 21.32±4.73ng/ml and in stable COPD state was 25.72±5.15ng/ml. On correlating the serum vitamin D level and FEV1% of predicted in stable COPD patients , in 25OHD deficiency COPD cases FEV1% of predicted was 28.10±6.17,in 25-OHD insufficiency cases was 35.92±8.03 and sufficiency case was 46.10±11.99. There was very strong positive correlation present between, serum 25-OHD and FEV1 % of predicted in stable COPD with Pearson correlation coefficient r= 0.742591,p value <0.001.

Conclusion:- Low serum vitamin D is common among COPD patients and is more in acute exacerbation of COPD state. There was very strong positive correlation present between, serum 25-OHD and FEV1.

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Introduction:-

Chronic Obstructive Pulmonary Disease [COPD], a common preventable and treatable disease, is characterized by persistent airflow limitation that is usually progressive and associated with an enhance chronic inflammatory response in the airways and the lungs to noxious particles or gases. Exacerbation and co morbidities contribute to the overall severity in individual patients. [1]

According to World Health Organization estimates, 65 million people have moderate to severe COPD. More than 3 million people died of COPD in 2005 corresponding to 5% of all deaths globally and it is estimated to be the third leading cause of death by 2020[2]. Crude estimates suggest there are 30 million COPD patients in India.[3]

Nowadays , the attention to nonskeletal effects of vitamin D has been increased (Kunisaki et al.,2011) . The patients with pulmonary diseases such as asthma and chronic obstructive pulmonary disease (COPD) are at greater risk of vitamin D deficiency [4-5]. In COPD, the risk of vitamin D deficiency is higher than expected and is linked with disease severity [6-7]. There is an association between the risk of upper respiratory infection and vitamin D deficiency in particular, the relation is stronger in patients with background respiratory disease [8-9]. Vitamin D in particular calciteriol exerts anti-inflammatory effect and modulates airways reactions in response to several stimulants like gases and noxious particles [10].

It also helps the remodeling of airways and reverses steroid resistance which is important characteristics of COPD . Several previously published studies have demonstrated a positive relationship between serum vitamin D and forced expiratory volume in 1 s (FEV1) in patients with COPD and asthma [8] as well as in healthy subjects [11]. In the Third National Health and Nutrition Survey (NHANES III), strong positive relations between serum 25(OH)D and FEV1 and forced vital capacity (FVC) were reported[12]. Regarding the high prevalence rate of vitamin D deficiency in these patients and the impact of vitamin D deficiency on airways, it is reasonable to compare the status of FEV1 volumes in patients with vitamin D deficiency versus patients with vitamin D sufficient COPD. For these reasons, the study was performed to compare serum 25-OH D status in patient with acute exacerbation and stable COPD state and investigate the relationship between serum vitamin D and FEV1 in patients with COPD.

Method:-

The study population was derived among the COPD patients presented to outpatient and inpatients pulmonary medicine department VSS Medical College, Burla between November 2013 and September 2015. Diagnosis of COPD was confirmed according to clinical pictures concurrent with airflow limitation defined as forced expiratory volume in 1s (FEV1) / forced vital capacity (FVC) less than 0.70 (FEV1/FVC ratio <70%) andFEV1<80% predicted. The severity of COPD was assessed by Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria.

All patients with confirmed diagnosis of COPD entered to the study. Exclusion criteria included: presence of pulmonary infection, tuberculosis, pleural effusion, congestive heart failure, primary pulmonary hypertension, pulmonary emboli, restrictive airway disease, and conditions associated with vitamin D metabolism, absorption or taking vitamin D containing medications.

Serum vitamin D was assessed by the measurement of 25-hydroxyvitamin D (25-OHD) using chemiluminescence method within 24 hours of admission. Serum25-OHD levels of less than 20 ng/ml were considered as vitamin D deficiency, levels at 20-30ng/ml as insufficient and levels $\geq$ 30 as sufficient[9].

Statistical analyses were carried out with SPSS software 2017 version. Experimental results are presented as mean±SD .The data were analyzed using student's t-test and Pearson correlation method (with a present probability of $p<0.05$).The correlation between serum vitamin D and that of FEV1 and FVC (percentage predicted) and FEV1/FVC were calculated.

Results:-

Patients' characteristics: Forty-six patients with mean age of 65.5±5.42 years were studied. The characteristics of study population are presented in table 1.

Table 1:-Characteristics of study population with chronic obstructive pulmonary disease (COPD).

Characteristics	No
No of patients	46
Age (mean ± SD)	65.5±5.42
Male	31(67%)
Female	15(33%)
Smoking, No(%)	33(72%)
GOLD Stage, No (%)	
Stage I	0(0%)
Stage II	7(15.3%)
Stage III	25(54.3%)
Stage IV	14(30.4%)
Mean serum 25-OHD (ng/ml)	
A/E of COPD	21.32±4.73
Stable COPD	25.72±5.15

The proportion of patients in stages 1 and 2 of GOLD was 0% and 15.3% and proportion of COPD in stages 3 and 54.3%, and 30.4% respectively. The mean serum vitamin D in acute exacerbation of COPD state was 21.32±4.73ng/ml and in stable COPD state was 25.72±5.15ng/ml but the difference was not statistically significant (p value >0.05).

Nearly 21.7% of stable COPD and 41.3% of acute exacerbation of COPD of patients had serum 25- OHD deficiency.

Mean FEV1 in serum 25-OHD deficient COPD was lower than sufficient COPD but the difference did not reach to a statistically significant level (0.721±0.153vs 1.034±0.160, p=0.45).
Table 2 presents the values of FEV1 according to serum 25-OHD levels. As shown in table 2, mean FEV1 volumes increase with raising serum 25-OHD concentrations. However, the mean FEV1 differences between various groups of serum 25-OHD did not reach to a statistically significant level (p=0.149).

Table 2:- Mean forced expiratory volumes in 1 s in patients with chronic obstructive pulmonary disease (COPD) according to serum 25-hydroxyvitaminD 25-OHD) levels.

Serum VitaminD	No of Patients	FEV1% PRED.	FEV1 IN LITER
Deficiency <20 ng/ml	10	28.10±6.17	0.721±0.153
Insufficiency 20-30 ng/ml	25	35.92±8.03	0.913±0.174
Sufficiency >30 ng/ml	11	46.10±11.99	1.034±0.160

It was found that (Table-3) there was significant positive correlation between serum 25-OHD and FEV1% predicted, FVC% of predicted, FEV1/FVC.

Table 3:- Correlation between serum level of 25-OHD and PFT in stable COPD

	Pearson coefficient -r	P
FEV1	0.742591	<0.001
FVC	0.387689	0.001
FEV1/FVC	0.48658	<0.001

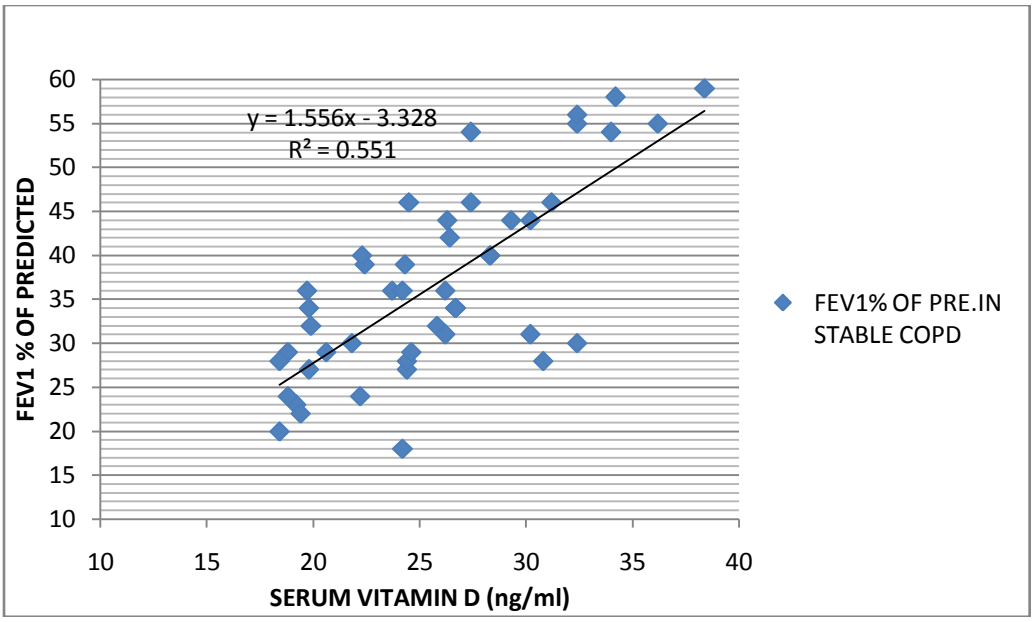

Figure 1:-Correlation between serum vitamin D and FEV1 in stable COPD patients.

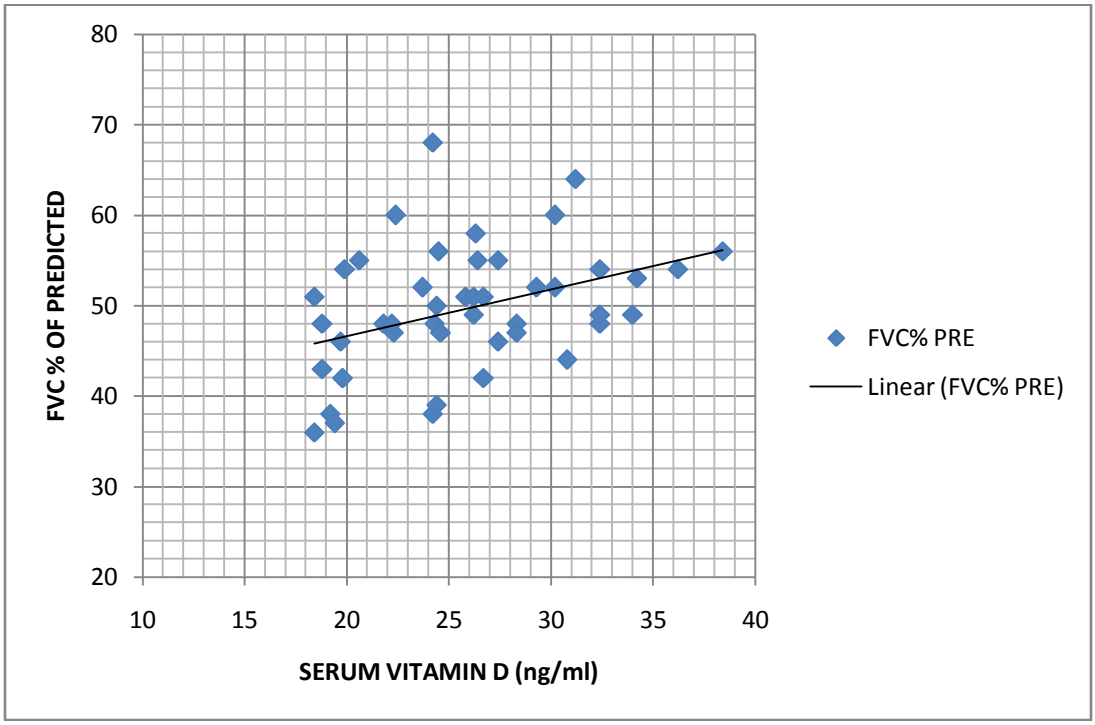

Figure 2:- Correlation between serum vitamin D and FVC in stable COPD patients.

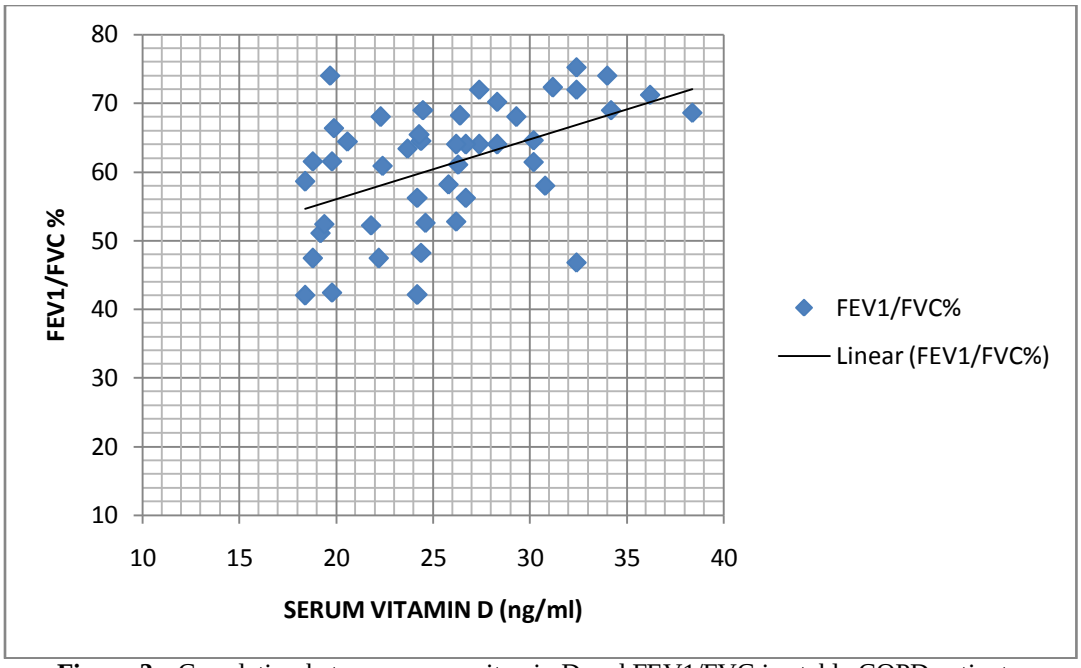

Figure 3:- Correlation between serum vitamin D and FEV1/FVC in stable COPD patients.

Discussion:-

This is a institution based prospective observational study constituting 46 known COPD cases diagnosed previously or at the time of hospitalization. In the same COPD patients' serum vitamin D was measured at the time of acute exacerbation and also during the stable state of follow up and for some patients serum vitamin D was measured during the stable state of COPD and following acute exacerbation of COPD.

In our study mean serum vitamin D level in A/E of COPD state was 21.32±4.73ng/ml and in stable COPD state was 25.72±5.15ng/ml. So in acute exacerbation of COPD state the mean serum vitamin D level was lower than the stable COPD state. It is similar with the **Zhang P et al**[13] (2012)found the level of 25-(OH)D in the A/E of COPD group was significantly lower than that in the stable COPD group (P<0.05).

In stable COPD state the mean serum vitamin D in male patients was 26.25±5.38 ng/ml and female was 24.63±4.64 ng/ml. In A/E of COPD state the mean serum vitamin D in male patients was 21.76±4.97ng/ml and female was 20.40±4.23ng/ml. So in our study showed that the mean serum vitamin D level was higher in male patients than female patients both stable and A/E of COPD state. This is in accordance with **P.N. Black et al**[12](2005) the serum 25-hydroxyvitamin D concentration was higher in men than in women. Lower value of serum vitamin D in female may be due female are less prone to sunlight exposure due less outdoor activity.

In low BMI had associated with low serum vitamin D Level than normal, overweight and obese patients. This is in accordance with **P.N. Black et al**[12](2005) the serum 25-hydroxyvitamin D concentration was inversely related to BMI. In lower BMI patients have low serum vitamin D may be due to lower storage capacity in muscle and fat due to wasting.

In our study serum vitamin D deficiency present in 19(41.3%) cases in acute exacerbation COPD state and 10(21.7%) cases in stable COPD state. The serum vitamin D insufficiency present in 24(52.1%) cases in A/E of COPD state and 25(54.3%) cases in stable COPD state. Serum vitamin D sufficiency present only in 3(6.6%) cases in A/E of COPD state and 11(24%) cases in stable COPD patients. So in our study both in stable and acute exacerbation of COPD state majority were in serum vitamin D insufficiency group.This is accordance with **Ringbaek et al**[14](2011) reported that 61 patient had Vitamin D deficiency (19.6%), 82 patient had vitamin D insufficiency (26.4%) in 311 COPD patients. **Franco CB et al**[15](2009) in a cross-sectional study 49 patients with mild and moderate COPD was determined, only 3 (6%) patients had sufficient vitamin D level , whereas 29 (59%)

patients had vitamin D insufficiency , 17 (35%) patients had deficiency.**Zhang P et al**[13] (2012) the prevalence of vitamin D deficiency was 52.78% in the A/E of COPD group and that was 39.47% in the stable COPD group. The total prevalence of vitamin D deficiency was 45.95% in COPD patients.

The men serum vitamin D level was 21.32±4.73ng/ml in A/E of COPD groups and 25.72±5.15ng/ml in stable COPD group.**Janssens et al**[7] (2009) said patients with COPD should be considered at high risk of vitamin D insufficiency because of reduction of outdoor activity, increased glucocorticoids induced catabolism, impaired activation as a consequence of renal dysfunction, and a lower storage capacity in muscle and fat due to wasting .

In our study showed there was very strong positive correlation present between, serum vitamin D and FEV1 % of predicted in stable COPD with Pearson correlation coefficient r= 0.742591 ,p value <0.001 .This is accordance with **Louise et al**[16] (2012) concluded that COPD was associated with an increased risk of vitamin D deficiency and important disease characteristics were significantly related to 25 hydroxy vitamin D levels especially FEV1 . **Black et al**.[12](2005) found a dose response relationship between 25hydroxyvitamin D and both FEV1 and FVC .

Conclusions:-

The results of this study indicate a correlation ship between serum 25-OHD levels and COPD. 25-OHD concentrations are lower in COPD patients who are current smokers, female, low BMI and increase in GOLD stages of COPD.

Deficient and insufficient of serum vitamin D levels were found in most of adult with acute exacerbation of COPD state and stable COPD state. Serum vitamin D level was found lower in acute exacerbation of COPD state than the stable state of COPD.

There is very strong positive correlation present between serum vitamin D and FEV1 in COPD. Also serum vitamin D level is positively associated with FVC and FEV1/FVC in COPD.

Vitamin D deficiency is associated with pulmonary function deterioration. So early detection of low serum vitamin D level and optimization of serum vitamin D level in COPD patients significantly will reduces the morbidity associated with COPD and improves quality of life in COPD patients.

However, more clinical trial of vitamin D measurement in relation with confounding factors such as physical activity, uv-rays exposure, nature of food intake, seasonal variation in a large population of COPD would help clarify further.

References:-

1. Global strategy for the diagnosis ,management, and prevention of chronic obstructive pulmonary disease(Revised 2015)
2. World Health Organization. Chronic obstructive pulmonary disease (COPD) Fact sheet No 315. World Health Organization, 2011
3. Salvi S, Agarwal A. India needs a national COPD prevention and Control program. J Assoc Physicians India 2012;60 Suppl: 5-7
4. Janssens W, Lehouck A, Carremans C, et al. Vitamin D beyond bones in chronic obstructive pulmonary disease time to act. Am J RespirCrit Care Med 2009; 179: 630-6.
5. Gilbert CR, Arum SM, Smith CM.Vitamin D deficiency and chronic lung disease.CanRespir J 2009; 16: 75-80.
6. Janssens W, Bouillon R, Claes B, et al. Vitamin D Deficiency is Highly Prevalent in COPD and Correlates with Variants in the Vitamin D Binding Gene. Thorax. 2010; 65: 215-20.
7. Janssens W, Mathieu C, Boonen S, Decramer M. Vitamin D deficiency and chronic obstructive pulmonary disease: a vicious circle. VitamHorm 2011; 86: 379-99.
8. Ginde AA, Mansbach JM, Camargo CA Jr.Association between serum 25-hydroxyvitamin D level and upper respiratory tract infection in the Third National Health and Nutrition Examination Survey. Arch Intern Med 2009; 169: 384-90.
9. HolickMF,Chen TC. Vitamin D deficiency:a worldwide problem with health consequences. Am J ClinNutr 2008; 87: 1080S-6S.

10. Hansdottir S, Monick MM, Hinde SL, et al. Respiratory epithelial cells convert inactive vitamin D to its active form: potential effects on host defense.JImmunol 2008;181: 7090-9.
11. Kunisaki KM, Niewoehner DE, Singh RJ, ConnettJE.Vitamin D status and longitudinal lung function decline in the Lung Health Study. EurRespir J 2011; 37: 238-43.
12. Black PN, ScraggR.Relationship between serum 25- hydroxyvitamin D and pulmonary function in the third national health and nutrition examination survey. Chest 2005; 128: 3792-8.
13. Prevalence of vitamin D deficiency and impact on quality of life in patients with chronic obstructive pulmonary disease Zhang P, Luo H, Zhu Y Zhong Nan Da XueXueBao Yi Xue Ban. 2012 Aug;37(8):802-6. doi: 10.3969/j.issn.1672-7347.2012.
14. Ringbaek T, Martinez G, Durakovic A, et al. Vitamin D status in patients with chronic obstructive pulmonary disease who participate in pulmonary rehabilitation. J Cardiopulmonary Rehab Prevention 2011; 31:261-267
15. Franco CB, PazFillho G, Gomes PE, et al. Chronic obstructive pulmonary disease is associated with osteoporosis and low levels of vitamin D. OsteoporosInt 2009;20:1881- 1887.
16. J.P. Louise, A. Marianne, S.H. Pieter, Chronic obstructive pulmonary disease is associated with low levels of vitamin D, PLoS one 7 (6) (2012) e38934.