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ANTIOXIDANT VITAMINS (A, C AND E) AND MALONDIALDEHYDE LEVELS IN ACUTE EXACERBATION AND STABLE PERIODS OF PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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ABSTRACT

Background: During exacerbations, those with stable episodes of persistent obstructive pulmonary disease (COPD) sustain oxidative damage, which gradually advances the illness's pathogenesis. Since the blood level of these nutrients in patients with COPD have not been thoroughly studied, we examined the levels of antioxidant vitamins and lipid peroxidation in individuals during acute flare-ups and stable periods.

Objective: Determining the amounts of malondialdehyde and antioxidant vitamins A, C, and E in individuals with chronic obstructive pulmonary disease during periods of acute exacerbation and stability was the goal.

Study Design: Prospective study

Place and Duration: Ayub Medical College, Abbottabad, from Jan 2022 to Jan 2023.

Methods: 56 COPD patients in all are experiencing an acute exacerbation. Using high-performance liquid chromatography and known techniques, the serum concentrations of malondialdehyde (MDA) and vitamins A, C, and E were measured before to therapy, during stable periods, and in 28 healthy controls. Every data was analysed using SPSS 23.0.

Results: Compared to the healthy group, the COPD group had considerably reduced plasma levels of vitamins A, E and C, as well as α- and βcarotenes and total carotenoids. There was a strong correlation between endogenous DNA damage to WBCs and plasma levels of vitamin E. Less significantly ($0.05< p <0.10$), we also discovered negative correlations between endogenous DNA damage and plasma levels of lutein or α-carotene. The total consumption of fruits and vegetables (OR=0.91; 95% CI=0.94-0.95) alone reduced the risk of COPD, Age and smoking history, both previous and current, separately increased the likelihood of COPD. These findings were obtained via

the logistic regression analysis. On the other hand, the risk of COPD was not influenced by the consumption of particular nutrients.
Conclusion: During periods of stability, the concentration of antioxidant vitamins A and E in the blood decreases during exacerbations, and patients with COPD experience greater oxidative stress during these episodes. The results of our research indicate that vitamin A and E supplementation may be helpful in preventing and treating the negative consequences of COPD.

Keywords: COPD, Malondialdehyde, Vitamins A, C, and E, Stable periods, Antioxidant

INTRODUCTION

The common, treatable, and avoidable illness known as chronic obstructive pulmonary disease (COPD) is characterised by persistent symptoms of breathing and restricted airflow caused by abnormalities in the alveolar or respiratory pathways, which are usually caused by extended exposure to toxic particles and gases. [1]A class of lung diseases known as COPD is progressive. Chronic bronchitis and emphysema are the most prevalent of these illnesses. These disorders are common in COPD patients. Emphysema causes the air sacs in your lungs to gradually deteriorate, preventing air from leaving your body. Because bronchitis causes tightness and inflammation, mucus can build up in the bronchial passageways.

Being a first-line health issue, COPD has a high morbidity and death rate. Globally, there were 299.40 million cases of COPD in 2017, according to statistics from the Burden from Disease Study [2]. Among the 282 causes included in the study, COPD ranked seventh in terms of cause of death with a mortality of 3.19, which is million cases (or around 5% of the total deaths during that year) [3].

It is estimated that 30% of COPD patients pass away from CVD. There are pathophysiological similarities between CVD and COPD that are closely linked to oxidative stress [4]. This review outlines the state of our knowledge on the systemic and local mechanisms that connect oxidative stress to a number of CVDs, including COPD. We concentrate on a few pertinent processes that coordinate the systemic reactions that cause the concurrent emergence of cardiovascular and respiratory dysfunctions. . In order to update and expand on earlier reviews in the field, we will describe biomarkers, talk about the relationship between COPD and CVDs more broadly rather than just focusing on a few particular CVDs, and highlight new, understudied mechanisms that connect the two disease entities through oxidative stress [5,6].

Vitamin levels in the serum were reported to be much lower in COPD patients than in control participants [7]. An further meta-analysis of 40 research including asthma patients supports the link between vitamins and pulmonary illnesses. A meta-analysis of the literature found that comparatively low dietary consumption of vitamins A and C was linked to statistically significant higher risks of wheeze and asthma [8].

Vitamins and lung function in both healthy individuals and COPD patients are linked, according to a significant number of research and reviews. Increased consumption of foods high in antioxidants may be linked to improved lung function, according to a recent randomised controlled experiment. Vitamins have also been linked in a number of studies to a decrease in symptoms, respiratory infections, and exacerbations.[9]

While the significance of vitamin D in respiratory illnesses has been established due to its connection to immunity, the mechanism of action for the majority of other vitamins is less obvious.[10]

Antioxidant capacity in plasma was lower in individuals experiencing acute exacerbations but not in clinically stable conditions.5 Patients' blood levels of oxidised glutathione and lipid peroxidation products were higher after exercise than those of controls.[11] Given the later results, which show that oxidative stress was caused by exercise, the exercising muscle is most likely the source of oxidative stress. An increased buildup of lipofuscin, an indication of oxidative damage, was identified in vastus lateralis samples from COPD patients in a research. This finding provides a clear indicator of oxidative stress in skeletal muscle.[12] Oxidative stress is linked to several ailments, and over the past

few decades, using antioxidant supplements has grown in popularity. Nevertheless, these supplements' harmful side effects and toxicity are sometimes overlooked.
The purpose of this study was to investigate the potential therapeutic benefits of ascorbic acid intake in conjunction with standard care for COPD patients.

MATERIALS AND METHODS

This prospective study was conducted at Ayub Medical College, Abbottabad, from Jan 2022 to Jan 2023 and comprised 56 COPD patients. From the health assessment centre at the same hospital or from nearby senior centres in the same city, 28 additional healthy controls were gathered who had no prior history of COPD or any of the other chronic conditions listed above. Patients with COPD and healthy controls were both at least 50 years old. Every subject gave their informed permission.
The following nutrients were evaluated by HPLC using fasting blood samples that were collected in heparin-containing tubes: retinol, α-tocopherol, ascorbic acid, lutein, α- and β-carotenes and lycopene. Ascorbic acid levels in plasma were measured within 4 hours of sample collection using methods. The detection wavelength of 295 nm was employed in reversed-phase HPLC to quantify plasma αtocopherol. We measured the amounts of retinol and particular carotenoid in plasma using the HPLC method described by Talwar et al. fourteen The HPLC test precisions, including intra- and interassay, varied from 10% to 15% as percentages of the coefficient of variation. To calculate total carotenoids in μmol/L, lutein, βcarotene, α-carotene, and lycopene were combined.
For statistical analysis, SPSS for Windows (version 23.0; SPSS, Inc., Chicago, IL) was used. Information is presented as means with standard deviation (SD) for all variables except categorical ones. With Student's t-tests, the differences between the two groups were compared. Chi-square tests or Fisher's exact tests were used to compare categorical variables. The relationship between antioxidant nutrients and endogenous and H2O2-induced extra DNA damage was evaluated using multiple linear regression analysis. To ascertain the relationship between the consumption of various fruits and vegetables and the levels of vitamin C or carotenoids, correlation analysis was employed. The relationship between nutrition and COPD risk was estimated using logistic regression analysis. When $p \leq 0.05$, statistical findings were regarded as significant.

RESULTS

There were 31 (55.4%) males and 25 (44.6%) females among COPD patients while 17 (60.7%) men and 11 (393%) women in control group. Mean age in COPD group was 49.9±4.17 years with mean BMI 25.5±3.21 kg/m^2 and in control group mean age was 52.7±3.15 years with mean BMI 24.5±2.35 kg/m^2.Other comorbidities were DM, kidney disease and hypertension among both groups.(table 1)

Table-1: Features of the patients that were enrolled

Variables	COPD (56)	Controls (28)
Gender		
Male	31 (55.4%)	17 (60.7%)
Female	25 (44.6%)	11 (39.3%)
Mean age (years)	49.9±4.17	52.7±3.15
Mean BMI (kg/m^2)	25.5±3.21	24.5±2.35
Comorbidities		
DM	22	10
Kidney Disease	16	3
HTN	20	15

Compared to the healthy group, the COPD group had considerably reduced plasma levels of vitamins A, C, and E, as well as α- and βcarotenes and total carotenoids.(table 2)

Table-2: Plasma levels of antioxidants agents among both groups

Variables	COPD (56)	Controls (28)
Plasma concentration of nutrients		
Vitamin C (μg/mL)	1.2±0.4	2.2±1.4
Vitamin E (μg/mL)	4.2±0.2	7.6 ±1.1
Vitamin A (μg/mL)	49.9±4.17	52.7±3.15
Lutein (μg/mL)	0.4±0.2	0.6±0.4
Total carotenoids (μg/mL)	0.50±1.21	1.7±2.5
Lycopene (μg/mL)	0.3±0.1	0.6±1.5
α-Carotene (μg/mL)	0.10±0.2	0.50±0.3

The total consumption of fruits and vegetables (OR=0.91; 95% CI=0.94-0.95) alone reduced the risk of COPD, while age and smoking experience (past plus present) independently raised the risk of COPD. These findings were obtained via the logistic regression analysis. On the other hand, the risk of COPD was not influenced by the consumption of particular nutrients.(table 3)

Table-3: Logistic regression-adjusted risk ratios for COPD based on certain characteristics

Variables	COPD (56)	Controls (28)
Odds Ratio		
Vitamin C (μg/mL)	1.94	0.98
Vitamin E (μg/mL)	1.95	0.87
Vitamin A (μg/mL)	1.5	0.98
Frequency of vegetables and fruit intake	0.95	1.45
Smoking status (current +former)	157	86.3
Daily intake of carbohydrate	0.98	0.82
Daily intake of protein	1.2	1.17

DISCUSSION

In light of the theory that oxidative stress plays a role in the pathogenesis of COPD, a deficiency in antioxidants may be associated with an increased risk of lung function decline.Thirteen An independent correlation between elevated FEV1 levels and blood levels of the antioxidant vitamins A, C, and E in addition to β-cryptoxanthin was demonstrated in a recent multivariate analysis.[14] In line with these conclusions, we also showed that COPD patients had considerably lower plasma levels of α and β-carotenes as well as vitamins A, C, and E than did healthy individuals. Moreover, in line with Ceylan et al.'s research, [15] we also showed that COPD patients had noticeably greater amounts of endogenous and H2O2-induced extra DNA damage than did healthy individuals. These results consistently imply that Taiwanese patients with COPD may be more susceptible to oxidative stress and have less resilience to it than do healthy individuals.

In this study, we found that the mean levels of overnight blood vitamin A, C, and E were higher then 0.2 μg/mL, >3 μg/mL, and >5 μg/mL in people with COPD versus healthy controls. These were considered to be within the acceptable range for people in good health.21 However, Ochs-Balcom et al. showed that in American participants with chronic airflow restriction, blood levels of -carotene, lutein/zeaxanthin, and lycopene were within 0.178, 0.439, or 0.132 μg/mL, respectively.[16]

Given the pathophysiological pathways behind oxidative stress in COPD, research on the potential impact of antioxidants on individuals with this condition is quite intriguing. These processes might be caused by environmental contaminants, recurring inflammation, protease/antiprotease imbalance, or the host's genetic response. Since inhaled cigarette smoke contains within 1015 free radicals that exist in the gas phase, smoking is the main risk factor for COPD. These free radicals include the creation of peroxide from hydrogen and superoxide dismutase. For people who smoke, the amount of ROS in their lungs rises. After the exposure described above, the respiratory system is harmed, and a systemic reaction occurs that is marked by a decrease in antioxidant molecules. This oxidative stress causes death, cellular damage, the production of inflammatory mediators, stimulation of the

creatine-dependent kinase pathway and gene transcription factors, among other cellular and molecular processes [17, 18]. On the other hand, firewood constitutes the biofuel that is most commonly utilised worldwide and was the biofuel that is most commonly used for cooking in underdeveloped nations.

Consistent with other studies, we found that the total amount of fruits and vegetables consumed was significantly associated with lower risk of COPD[19], rather than particular forms of vitamin C or carotenoids. This may be explained by the fact that fruits and vegetables additionally contain a range of other beneficial phytochemicals, which such as flavonoids, which which are prevalent in plant foods and have been demonstrated to have a variety of bioactivities, including anti-inflammatory and antioxidative properties, in addition to carotenoids as well as vitamin C. [20] Tabak et al. discovered a favourable correlation between FEV1 and the total consumption of flavonol, flavone, and catechin in a Dutch cohort research. [21] It is plausible that the limited sample size in our investigation may have contributed to the lack of discernible negative relationships between certain antioxidative nutrients and lung performance.

An unanticipated result of our analysis was that there was minimal correlation between the plasma levels of our patients and the amounts of carotene and vitamin C they consumed through food. However, as the dietary allowance was determined using an FFQ, measurement errors in calculating carotenoid and vitamin C consumption may have contributed to the weak connection.

CONCLUSION

During periods of stability, the concentration of antioxidant vitamins A and E in the blood decreases during exacerbations, and patients with COPD experience greater oxidative stress during these episodes. The results of our research indicate that vitamin A and E supplementation may be helpful in preventing and treating the negative consequences of COPD.

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