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Effect of Antioxidant Supplements on Oxidative Stress, Disease Severity and Bacterial Infection in Cystic Fibrosis Children

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Abstract

Background: Cystic fibrosis (CF) is a multisystem disease, which is characterized by impaired secretion of the exocrine glands and affects many organs, especially the digestive and respiratory systems leading to the continuous development of respiratory infections, which are associated with poor clinical outcomes. Children with CF experience on-going oxidative stress and inflammation, which contribute to disease severity and worsening lung function. Antioxidant supplementation may enhance benefits in those patients by directly counteracting the process of oxidative stress.

Aim of Study: The study evaluated the effect of antioxidants supplementation on the level of oxidative stress, as measured by 3-Nitrotyrosine and its implications on bacterial colonization and disease severity among CF children.

Patients and Methods: This randomized controlled clinical trial study was conducted at CF Clinic, Children's Hospital, Ain Shams University after approval of Ethical Research Committee at Ain Shams University Hospitals from March 2024 till September 2024. Sixty patients assigned randomly into 2 groups: Study group and control group. Patients in both groups received Mediterranean diet (MD) and the study group received antioxidant oral preparation in addition to MD for 6 months. All participants were subjected to the following initially and after 6 months of intervention: Medical history, clinical assessment stressing on clinical severity assessment using the CF-ABLE score, laboratory investigations (sputum culture and serum 3-nitrotyrosine level as a marker of oxidative stress) anddietary adherence was evaluated using 24-hour dietary recall and the KIDMED score.

Results: The study group, who received MD and antioxidant supplementation, showed a significant reduction in 3-nitrotyrosine levels compared to the control group (p-value = 0.003), indicating decreased oxidative stress. Surprisingly, CF-ABLE scores showed greater improvement in the control group (p=0.035) compared to the study group. Both groups exhibited similar trends in sputum culture results, indicating that additional antioxidant supplementation did not provide significant added benefits in bacterial infection control.

Conclusion: MD alone may provide significant benefits in reducing oxidative stress while also supporting better lung function and disease stabilityin children with CF. Nevertheless, further larger scale studies are recommended to highlight any additional benefits of antioxidant supplementation.

Key Words: *Antioxidant supplementation – Oxidative stress – Disease severity – Bacterial infection – Cystic fibrosis.*

Introduction

CYSTIC fibrosis (CF) is a multisystem disease caused by certain mutations causing defective or absent CF transmembrane conductance regulator (CFTR) protein, the main function of which is the trans-epithelial anions transport. Hence, CF is characterized by impaired secretion of the exocrine glands and affects many organs, especially the digestive and respiratory systems leading to the continuous development of respiratory infections, especially Pseudomonas aeruginosa and Staphylococcus aureus, which are associated with poor clinical outcomes **[1].**

CFTR deficiency causes oxidative stress in the airway epithelium of CF patients, affecting multiple bioactive lipid metabolic pathways, which are likely to play a role in lung disease progression **[2].**

Moreover, many comorbidities emerging with the increasing patient survival times and improved quality of care lead to exacerbated production of reactive oxygen species (ROS), exceeding the levels required for optimal physiological functioning **[3].**

Over-generation of ROS results in a structural modification of cellular proteins, leading to changes in their function and aggregation, and therefore, cell dysfunction and cellular processes impairment **[4].**

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3-Nitrotyrosin is one of the promising biomarkers of oxidative stress, which is formed by the nitration of protein and free tyrosine residues by reactive peroxynitrite molecules. The 3-nitrotyrosine concentration is significantly elevated in CF patients [5,6].

Due to the pathogenesis of the disease, malabsorption and the energy deficit, the standard of care for patients with CF is a high-calorie and high-fat diet with pancreatic enzyme replacement therapy (PERT) and the oral supplementation of vitamins [7].

In the current study, the target of nutritional management is to reach and maintain an optimal nutritional status and decrease the level of oxidative stress, bacterial colonization and disease severity among CF children through dietary plan following MD (high amounts of olive oil and olives, fruits, vegetables, unrefined cereals, legumes, and nuts, moderate amounts of fish and dairy products, and low quantities of meat and meat products) fortified by antioxidant supplementation [8].

Aim of the work:

The current study was designed to explore the effect of antioxidants supplementation on the level of oxidative stress, as measured by 3-Nitrotyrosine, bacterial colonization and diseases severity among CF children.

Patients and Methods

This randomized controlled clinical trial studywas conducted at CF Clinic, Children's Hospital, Faculty of Medicine, Ain Shams University.

The current study was conducted after approval of Ethical Research Committee at Ain Shams University Hospitals and after obtaining an informed written consent/assent from all caregivers and participants (after explaining the steps of the study, aims, and potential benefits and hazards) with the ethical committee approval number of FMASU M S 98/2024.

Patients: Sixty patients aged from 6 months to 18 years with documented diagnosis of CF who were diagnosed according to CF Foundation guidelines based on 2 consecutive positive sweat tests and/or the presence of a mutation in the homozygous state or two heterozygous mutations on the gene encoding the cystic fibrosis transmembrane conductance regulator (CFTR) protein [9], and after exclusion of current pulmonary exacerbations, severe sepsis and comorbid systemic illnesses, patients were randomly as signed into 2 groups: Group I (the study group): Who received a tailored dietary plan to cover macronutrients needs according to CF foundation guidelines following MD, which characterized by high amounts of olive oil, fruits, vegetables, unrefined cereals, legumes, and nuts, moderate amounts of fish and dairy products, and low quantities of meat and meat products [8], which fortified by antioxidant supplementationin specific doses in the form of an oral liquid form(each 5ml contains: 200mg vitamin E, 300mg vitamin C, 90µg Se, 500µg vitamin A, 30mg zinc, 3mg copper and 2000 IU vitamin D) [10].

In children under 5 years of age, the oral liquid form of antioxidant was administered in three divided doses: 1.5cm with breakfast, 2cm with lunch and 1.5cm with dinner. For children over 5 years of age, the full dose was taken once daily without division.

The side effects of this oral antioxidant combination that were reported during the study period were nausea, vomiting, epigastric pain and diarrhea. These side effects were ameliorated by taking the formula during or half an hour after eating, not before eating.

Group II (the control group): Received a tailored dietary plan, the same as the study group [8] with fat soluble vitamins supplementation (150µg vitamin A, 2000 IU vitamin D, 100mg vitamin E and 1000 µg vitamin K) for 6 months [12].

Compliance to the Mediterranean diet (MD) was assessed in all patients using the KIDMED index at 8,16 and 24 weeks [13].

Patients in both groups were subjected to the following initially and after the intervention: Full detailed medical history including: Sociodemographic characteristics as: Date of birth, gender, order of birth, consanguinity, socioeconomic status and residency, data related to the diagnosis for example the age of onset of symptoms, age at diagnosis, medication history, frequency of hospital and paediatric intensive care unit (PICU) admission and dietary assessment using 24-hour recall which was analyzed using software based on food composition tables of National Nutrition Institute 2006 [14]. We used an Arabic version of the food analysis program that analyzed the 24-h dietary recall into detailed macro and micronutrient analysis, then these data were classified into low, high or within average intake according to RDA for each age group [12,15].

Dietary content of Na, K, Ca, Ph, zinc, iron and fibers was categorized according to RDA to low, average and high [16].

History of presenting symptoms with a special focus onrespiratory symptoms including productive cough, sputum (colour and amount), wheezes, dyspnea, respiratory distress and symptoms of exacerbations (increased cough and expectoration, increased wheezing, haemoptysis, breathlessness, exercise intolerance and new infiltrates in chest X-ray or high-resolution CT chest). Pancreatic insufficiency symptoms including faltering growth, steatorrhea, polydepsia and polyuria as well as gastrointestinal

symptoms as abdominal pain, bloating and vomiting were stressed upon. Symptoms suggestive of fat-soluble vitamins deficiency whether vitamin A deficiency as dry skin, dry eyes and night blindness, vitamin D deficiency asfatigue, bone pain or achiness and muscle weakness, vitamin E deficiency asmuscle weakness, coordination and walking difficulties and decrease night vision and vitamin K deficiency asbruising and bleeding *[17]* were also stressed upon. Thorough clinical examination was done including complete general examination of the patients focusing on vital data (heart rate, respiratory rate, oxygen saturation, heart rate, capillary refill time and body temperature) *[18]*. Local chest examination was performed to detect diminished air entry, wheezes, crackles, fine crepitations, and signs of respiratory distress (nasal flaring, subcostal retraction and clammy skin). Local abdominal examination explored anyabdominal distentionorhepatomegaly.

The Mediterranean Diet Quality Index (KIDMED Index) *[13]*: The Mediterranean Diet Quality Index (KIDMED Index) is frequently used to evaluate adherence to the Mediterranean Dietary Pattern among children and adolescents, through sixteen questions with the associated total score ranging from -4 to 12. Compliance to the MD was assessed in all patients using the KIDMED questionnaire and KIDMED index (taken from parents) at 8,16 and 24 weeks *[13]*.

Laboratory workup and blood sampling: Blood collection was performed with care to avoid stasis, haemolysis or contamination by tissue fluids, or exposure to glass. Specimens were kept at room temperature.

3-Nitrotyrosine was assessed by Enzyme Linked Immunosorbent Assay (ELISA). The plate has been pre-coated with human NT antibody. Nitrotyrosine present in the sample was added and binds to NT in the sample, then streptavidin-HRP was added and binds to the biotinylated NT antibody. After incubation unbound streptavidin-HRP was washed away during a washing step. Substrate solution was then added, and color develops in proportion to the amount of human NT. The reaction was terminated by addition of acidic stop solution and absorbance is measured at 450nm *[20,21]*.

Sputum culture was performed for all patients in both groups upon enrolment and after intervention. Sputum collection in children was done byspontaneous expectoration for older children who can produce sputum, induced sputum collection (using hypertonic saline nebulization) was also used, oropharyngeal (throat) swabs for younger children who cannot expectorate as well as bronchoalveolar lavage (BAL) for deeper lung sampling, usually in research or severe cases *[22]*.

Clinical severity assessment was done by CF-ABLE score *[23]*. The ABLE score uses clinical parameters that are measured at every clinic visit and scored on a scale from 0 to 7. If FEV1 is <52%, then 3.5 points are added; if the number of exacerbations in the past 3 months is >1, then 1.5 points are added; if BMI is <20.1kg/m^2 or age <24 years, each receive 1 point. Since pulmonary function tests are assessed only in children over six years old, and the CF-ABLE score is calculated based on FEV1, so it was determined for 13 patients in the extra care group and 17 patients in the regular care group. Patients with a low score have a very low risk of death or lung transplantation within 4 years; however, as the score increases, the risk significantly increases. Patients who score >5 points have a 26% risk of poor outcome within 4 years. (scoring from 0 to 3: mild, from 3.5 to 5: moderate and from 5.5 to 7: severe).

For statistical analysis data was collected, revised, coded and entered to the Statistical Package for Social Science (IBM SPSS) (IBM Corp. Released 2020. IBM SPSS Statistics for Windows, Version 27.0. Armonk, NY: IBM Corp). The quantitative data were presented as mean, standard deviations and ranges when parametric and median, inter-quartile range (IQR) when data found non-parametric. Qualitative variables were presented as number and percentages.

The comparison between groups regarding qualitative data was done by using Chi-square testand/ or Fisher exact test when the expected count in any cell found less than 5.

The comparison between two independent groups with quantitative data and parametric distribution was done by using Independent t-test while with non-parametric distribution were done by using Mann-Whitney test.

The comparison between two paired groups regarding quantitative data and parametric distribution was done by using Paired t-test while with non-parametric distribution was done by using Wilcoxon Rank test.

The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant as the following:

- p-value >0.05: Non-significant (NS).
- p-value <0.05: Significant (S).
- p-value <0.01: Highly significant (HS).

Results

The current study included 60 patients (51.6% females, 48.4% males) diagnosed with CF, randomly assigned into 2 groups (group I patients “the study group”) and (group II patients “the control group”).

The median age upon enrollment at the study group was 4.75 years (range 1.1-15.3 years) with

median age of diagnosis 10.5 months (range 1-108 months) and median duration of disease 3.75 years (range 1-12.5 years).

While the control group, the median age upon enrollment was 7.79 years (range 2.22-14.2 years) with median age of diagnosis 8 months (range 2-96 months) and median duration of the disease 4.5 years (range 1-14 years) as described in Table (1).

Table (1) shows that there was no statistically significant difference between the study group and control group regarding sex distribution, age of the studied patients, consanguinity, family history, duration of disease and age at diagnosis.

Comparison between the two groups upon enrollment of the study:

Table (2) shows that there was significantly higher median number of hospital admissions upon enrollment for the study group than control group with *p*-value = 0.014. The same table shows that there was no statistically significant difference between both groups regarding the other studied parameters.

Regarding oxidative stress marker (3-Nitrotyrosine), there was no statistically significant difference in serum 3-nitrotyrosine levels with *p*-value=0.068, as demonstrated in Fig. (1). Also, there was no significant difference between both groups regarding sputum culture at enrollment with *p*-value=0.284.

Table (3) shows that there was no significant difference between the study group and control group regarding CF-ABLE score upon enrollment of the study.

Comparison between the study group and control group after intervention:

Regarding severity parameters there was significant lower median number of hospital admission after intervention in the control group than the study group as demonstrated in Fig. (2) with *p*-value= 0.007, while no significant difference between both groups regarding the number of exacerbations nor number of pediatric intensive care unit admissions within the 6 months of intervention) were detected.

Regarding oxidative stress marker (3-Nitrotyrosine), there was significantly lower serum level of 3-nitrotyrosine in the study group than the control group after intervention with *p*-value = 0.003, as demonstrated in Fig. (3). Mean while, there was no significant difference between both groups regarding sputum culture after intervention with *p*-value = 0.432.

The current study results showed that CF-ABLE score after intervention was significantly lower in the control group than the study group with *p*-value = 0.035 as demonstrated in Fig. (4).

Table (1): Comparison between the study group and control group regarding demographic data and characteristics of the studied patients.

Demographic data	Study group No. = 30	Control group No. = 30	Test value	*p*-value	Sig.
Sex:					
Female	15 (50.0%)	16 (53.3%)	0.067*	0.796	NS
Male	15 (50.0%)	14 (46.7%)			
Age (years):					
Median (IQR)	4.75 (3.27 – 9.2)	7.79 (3.38 – 10.1)	-0.917#	0.359	NS
Range	1.1 – 15.3	2.22 – 14.2			
Consanguinity:					
Negative	13 (43.3%)	12 (40.0%)	0.333*	0.954	NS
Positive	17 (56.7%)	18 (60.0%)			
Family history:					
Negative	20 (66.7%)	19 (63.3%)	0.073*	0.787	NS
Positive	10 (33.3%)	11 (36.7%)			
Duration of disease (years):					
Median (IQR)	3.75 (2 – 8)	4.5 (3 – 8.5)	-0.698#	0.485	NS
Range	1 – 12.5	1 – 14			
Age of diagnosis (months):					
Median (IQR)	10.5 (6 – 24)	8 (6 – 24)	-0.185#	0.853	NS
Range	1 – 108	2 – 96			

p-value >0.05: Non-significant. *p*-value <0.05: Significant. *p*-value <0.01: Highly significant.
*: Chi-square test. #: Mann-Whitney test.

Table (2): Comparison between the study group and the control group regarding severity parameters upon enrollment in the study.

Severity parameters	Study group No. = 30	Control group No. = 30	Test value	p-value	Sig.
Number of exacerbations 6 months before enrollment:					
Median (IQR)	10.5 (8 – 15)	10 (7 – 12)	-0.823#	0.411	NS
Range	4 – 24	2 – 25			
Number of hospital admissions 6 months before enrollment:					
Median (IQR)	6 (3 – 8)	4 (2 – 5)	-2.454#	0.014	S
Range	0 – 15	0 – 8			
Number of pediatric intensive care unit admissions 6 months before enrollment:					
Median (IQR)	1.5 (0 – 3)	1 (0 – 2)	-1.201#	0.230	NS
Range	0 – 11	0 – 5			

p-value >0.05: Non-significant. p-value <0.05: Significant. p-value <0.01: Highly significant.
*: Chi-square test. •: Independent t-test. #: Mann-Whitney test.

Table (3): Comparison between the study group and control group regarding CF-ABLE score upon enrollment in the study.

CF-ABLE score Upon enrolment	Study group No. = 13	Control group No. = 17	Test value	p-value	Sig.
CF-ABLE score:					
Mean ± SD	4.39±1.76	3.74±1.32	1.189•	0.244	NS
Range	2 – 7	2 – 7			
CF-ABLE score Interpretation:					
Mild	1	2	1.451*	0.484	NS
Moderate	9	13			
Severe	4	2			

p-value >0.05: Non-significant. p-value <0.05: Significant. p-value <0.01: Highly significant.
*: Chi-square test. •: Independent t-test.

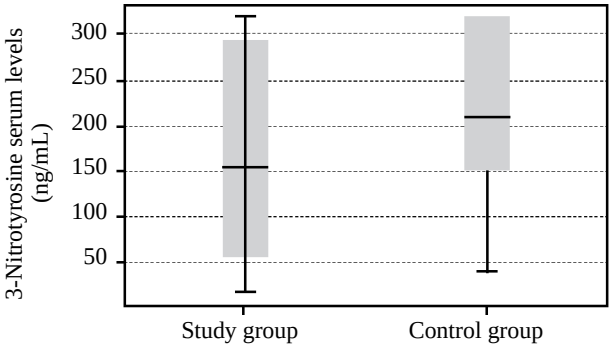

Fig. (1): Comparison between 3-Nitrotyrosine serum level (ng/mL) interpretation upon enrollment in study and the control group.

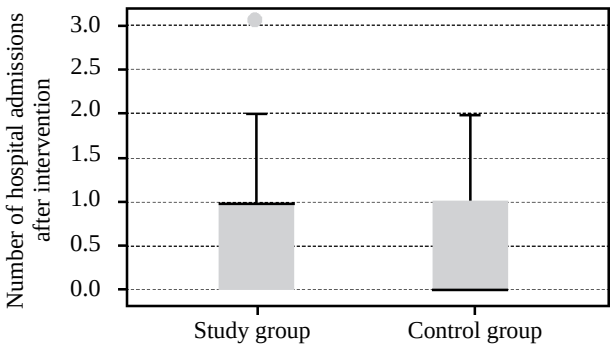

Fig. (2): Comparison between study group and control group regarding number ofhospital admissions after 6 months of intervention.

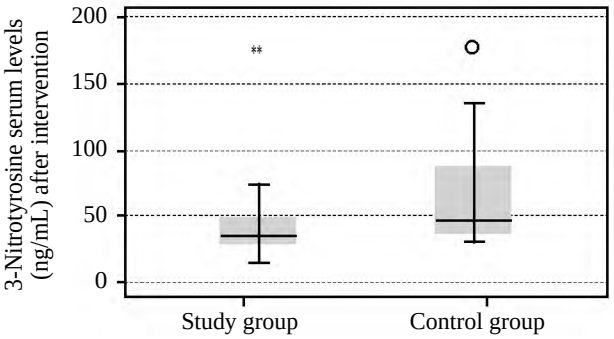

Fig. (3): Comparison between the study group and the control group regarding 3-nitrotyrosine serum level after 6 months of intervention.

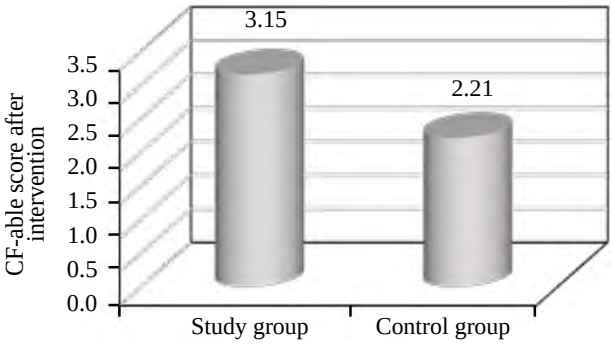

Fig. (4): Comparison between the study group and control group regarding CF-ABLE score after 6 months of intervention.

Discussion

MD is recognized for its anti-inflammatory and antioxidant properties, it has been linked to improved outcomes in children with CF, including reduced oxidative stress, lower bacterial colonization and potentially milder disease severity. Its high content of polyphenols, omega-3 fatty acids, and essential vitamins may help counteract chronic inflammation and oxidative damage **[24].**

This randomized controlled clinical trial included 60 children with cystic fibrosis (CF) from Cystic Fibrosis Outpatients' Clinic at Ain Shams University, Pediatric Hospital. Participants were randomly assigned into one of two groups: The study Group (n=30) (The number of patients in the extra care group after the intervention was 29, as one patient passed away during the study), who received a MD plus an antioxidant supplement regimen (vitamins E, C, A, D, selenium, zinc, and copper), and the control Group (n=30), who followed the MD with only the standard supplementation with fat-soluble vitamins (vitamins A, D, E, and K).

In the current study there was no significant difference between the two groups regarding the KIDMED index at weeks 8, 16, and 24 of the study. In both groups, most of patients demonstrated a moderate level of adherence to the MD through out the study period.

Regarding severity parameters, the current study showed that;there were no significant differences observed between the two groups after the intervention regarding the number of exacerbations and Pediatric Intensive Care Unit (PICU) admissions. Similarly, the rate of change in these parameters did not differ between groups. However, each group experienced a significant reduction in both exacerbations and PICU admissions post-intervention compared to baseline with p-value <0.001 in each group.

Conversely, the number of hospital ward admissions was notably higher in the study group than in the control group upon enrolment [(median (IQR) 6 (3 – 8) and 4 (2 – 5) respectively) and after the intervention (median IQR 1 (0 – 1) and 0 (0 – 1) respectively], with no significant difference in the rate of change between groups. Nonetheless, both groups exhibited a significant decrease in hospital admissions post-intervention compared to baseline with p-value <0.001 in each group.

These findings align with the study by Sagel et al. (2018), which evaluated the effects of an antioxidant-enriched multivitamin supplement in individuals with CF. Conducted across multiple centres, this randomized, double-blind, placebo-controlled trial involved 73 participants aged 10 years and older. The study found that antioxidant supplements were highly effective in raising antioxidant levels in the body, which in turn reduced the risk of disease exacerbation, hospital admissions for intravenous antibiotics, and PICU admissions **[25].**

Additionally, Poulimeneas et al. **[26]** conducted a cross-sectional study examining dietary adherence and nutrient intake among 76 pediatric CF patients at Aghia Sophia Children's Hospital in Athens, Greecethe study assessed adherence to Cystic Fibrosis Foundation (CFF) dietary guidelines, which recommend a high-calorie, high-fat diet to meet the increased energy needs of individuals with cystic fibrosis. The findings revealed a positive correlation between adherence to this dietary approach and a reduction in the number of exacerbations, hospital admissions, and PICU admissions **[26].**

Regarding laboratory parameters: Sputum culture results also showed no significant differences between the groups at enrollment or after the intervention, with no change in bacterial colonization rates in either group. Within-group analysis in the study group revealed no statistically significant changes in laboratory parameters post-intervention; however, sputum culture results showed improvement, with the prevalence of positive cultures de-

creasing from 70% to 53.3%, though this reduction did not reach statistical significance.

Furthermore, Sagel et al. [25] explored the effects of antioxidant supplementation on bacterial colonization. While their study demonstrated that antioxidant supplementation effectively increased systemic antioxidant levels, it did not result in significant changes in sputum culture findings, suggesting that bacterial colonization in CF patients may not be significantly influenced by antioxidant intake alone [25].

More broadly, the laboratory parameters assessed in the current study may have been affected by multiple variables, including the severity of the disease, nutritional status, genetic variability, and underlying inflammatory responses. Given these complexities, further research with larger sample sizes and extended follow-up periods is essential to determine whether antioxidant supplementation can lead to statistically significant improvements in laboratory biomarkers in children with CF.

Regarding the oxidative stress marker (3-nitrotyrosine), the current study showed that, there was no significant difference in initial serum 3-nitrotyrosine levels between the two study groups. However, following the intervention, a significant reduction in 3-nitrotyrosine serum level (ng/mL) was observed in both groups, with a more pronounced decrease the study group [from median (IQR) 154.35 (57.19 – 294) to 35 (27.38 – 47.93)] compared to the control group [from median (IQR) 208.45 (151.2 – 320) to 46.13 (37.07 – 88.76)].

This study is among the first to investigate the effects of a MD supplemented with antioxidants on oxidative stress (3-Nitrotyrosine) in children with CF.

Supporting these findings, Galiniak et al. [6] demonstrated that CF patients infected with Pseudomonas aeruginosa exhibited significantly higher 3-nitrotyrosine concentrations compared to healthy controls. Furthermore, a positive correlation was observed between BMI and 3-nitrotyrosine levels, while an inverse correlation was noted between 3-nitrotyrosine and FEV1, indicating a potential link between oxidative stress and pulmonary function in CF patients [6].

Regarding CF-ABLE scoring to assess clinical severity, the current study showed, upon enrollment, there was no significant difference in CF-ABLE scores between the two groups. On the other hand, the mean CF-ABLE score after intervention was significantly lower in the control group than the study group with p-value = 0.035. Within-group analysis revealed that CF-ABLE scores significantly decreased in both groups after the intervention compared to baseline, indicating an overall improvement in disease severity.

This study is among the first to investigate the impact of a MD enriched with antioxidant supplements on disease severity in children with CF, as assessed by the CF-ABLE score.

Supporting the importance of this scoring system, Zhou et al. [27] conducted a study evaluating the relationship between CF-ABLE scores and disease progression in CF patients. Their study, conducted in China included 67 patients from the Peking Union Medical College Hospital CF and found that higher CF-ABLE scores were significantly associated with increased mortality risk. These findings highlight the clinical relevance of CF-ABLE as a predictive tool for poor prognosis in CF patients [27].

Conclusion:

MD alone may provide significant benefits in reducing oxidative stress while also supporting better lung function and disease stability in children with CF. Further larger scale studies are recommended to explore any additional benefits of antioxidant supplementation during nutritional management of CF patients.

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تأثير مكملات مضادات الأكسدة على الإجهاد التأكسدى وشدة المرض والعدوى البكتيرية لدى الأطفال المصابين بالتليف التكيسى

الخلفية: التليف التكيسى هو مرض يصيب أجهزة متعددة، يتميز بضعف إفراز الغدد الخارجية، ويؤثر على العديد من الأعضاء، وخاصة الجهازين الهضمى والتنفسى، مما يؤدى إلى تطور مستمر لالتهابات الجهاز التنفسى، والتى ترتبط بنتائج سريرية سيئة. يعانى الأطفال المصابون بالتليف التكيسى التكيسى من إجهاد تأكسدى والتهاب مستمر، مما يساهم فى شدة المرض وتدهور وظائف الرئة. قد تعزز مكملات مضادات الأكسدة الفوائد لدى هؤلاء المرضى من خلال مواجهة عملية الإجهاد التأكسدى بشكل مباشر.

هدف العمل: قيّمت الدراسة تأثير مكملات مضادات الأكسدة على مستوى الإجهاد التأكسدى، كما تم قياسه بواسطة ٣-نيتروتيروسين، وآثاره على الاستعمار البكتيرى وشدة المرض لدى أطفال التليف الكيسى.

المرضى والطرق: أجريت هذه الدراسة السريرية العشوائية المضبوطة في عيادة التليف التكيسى، مستشفى الأطفال، جامعة عين شمس، بعد موافقة لجنة البحوث الأخلاقية فى مستشفيات جامعة عين شمس. تم تقسيم ستين مريضًا عشوائيًا إلى مجموعتين: مجموعة الدراسة ومجموعة الضبط. تلقى المرضى فى كلتا المجموعتين حمية البحر الابيض المتوسط، بينما تلقت مجموعة الدراسة مستحضرًا فمويًا مضادًا للأكسدة بالإضافة إلى حمية البحر الأبيض المتوسط لمدة ٦ أشهر. خضع جميع المشاركين لما يلى فى البداية وبعد ٦ أشهر من التدخل: التاريخ الطبى، والتقييم الاكلينيكى لشدة المرض باستخدام درجة CF-ABLE، والفحوصات المخبرية (مزراعة البلغم ومستوى ٣-نيتروتيروسين فى المصل كمؤشر للإجهاد التأكسدى)، وتم تقييم الالتزام الغذائى باستخدام التذكير الغذائى لمدة ٢٤ ساعة ودرجة KIDMED.

النتائج: أظهرت مجموعة الدراسة، التي تلقت حمية البحر الأبيض المتوسط ومكملات مضادات الأكسدة، انخفاضًا كبيرًا فى مستويات ٣-نيتروتيروسين مقارنةً بالمجموعة الضابطة (القيمة الاحتمالية = ٠,٠٠٣)، مما يشير إلى انخفاض الإجهاد التأكسدى. ومن المثير للدهشة أن درجات CF-ABLE أظهرت تحسنًا أكبر فى المجموعة الضابطة (القيمة الاحتمالية = ٠,٠٣٥) مقارنةً بمجموعة الدراسة. أظهرت كلتا المجموعتين اتجاهات متشابهة فى نتائج زراعة البلغم، مما يشير إلى أن مكملات مضادات الأكسدة الإضافية لم تقدم فوائد إضافية كبيرة فى مكافحة العدوى البكتيرية.

الخلاصة: قد يُوفر العلاج الدوائي وحده فوائد كبيرة فى تقليل الإجهاد التأكسدى، مع دعم تحسين وظائف الرئة واستقرار المرض لدى الأطفال المصابين بالتليف التكيسى. ومع ذلك، يُوصى بإجراء المزيد من الدراسات على نطاق أوسع لتسليط الضوء على أى فوائد إضافية لمكملات مضادات الأكسدة.