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Research Paper

The Role of Omega-3 in Improving Clinical Symptoms of Children With Urinary Tract Infections: A Randomized Clinical Trial

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ABSTRACT

Background and Aim: Inflammatory urinary tract infection (UTI) is a common infectious disease in childhood, causing significant discomfort. Omega-3 fatty acids are well-known for their anti-inflammatory properties, which may aid in decreasing UTI symptoms. This study aimed to investigate the effects of omega-3 therapy in children with UTI.

Methods: This randomized clinical trial enrolled 100 children with UTIs, randomized into placebo and intervention groups. In addition to standard treatment, the intervention group received one omega-3 capsule daily. Symptoms were assessed at the baseline and again after the treatment period.

Results: At baseline, no significant differences were observed between the two groups in age, gender, or symptom prevalence. However, after the treatment period, omega-3 supplementation resulted in a significant decrease in dysuria and urinary frequency symptoms compared to the placebo group.

Conclusion: Omega-3 supplementation as adjunct therapy can significantly improve the severity of symptoms in children with UTIs.

Keywords: Urinary tract infections (UTIs), Omega-3, Inflammation, Children

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Introduction

Urinary tract infection (UTI) is a common bacterial infection in children. Clinically, these infections are categorized into two main types: Upper UTIs (acute pyelonephritis) and lower UTIs (cystitis). Treatment for UTIs typically requires a 10-day course of antibiotics [1-6].

The pathogenic response of the urinary tract to bacteria is mediated by P-fimbriae binding through glycolipid receptors, which subsequently activate toll-like receptors (TLRs). Activation of these TLRs leads to the translation of other factors, including interferon regulatory factor 3, triggering neutrophil recruitment and cytokine production. These mechanisms are responsible for the clinical symptoms experienced by patients. Urothelial cells produce interleukin-8 (IL-8), which attracts neutrophils to the urinary tract, causing the pyuria. The infection itself also upregulates IL-8 receptor expression, further stimulating neutrophil production and recruitment. Additionally, urothelial cells secrete IL-6, which increases C-reactive protein (CRP) production and stimulates mucosal IgA production.

Since UTIs are among the most prevalent infections and inflammatory conditions in children, causing significant discomfort, finding adjunctive therapies to alleviate symptoms and expedite recovery has always been a focus of interest for physicians and researchers.

Long-chain dietary polyunsaturated fatty acids (n-3 PUFAs), including eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), have significant anti-inflammatory effects. Some mechanisms underlying these effects are well-documented, such as the inhibition of nuclear factor kappa B (NF-κB) activation, a key regulator of T cells. These fatty acids also modulate COX-2 gene expression and innate immune responses. Additionally, studies have shown that serum levels of CRP, interleukin (IL)-6, and tumor necrosis factor-α (TNF-α) decrease during treatment with n-3 polyunsaturated fatty acids (n-3 PUFA) supplementation.

Given the above, it is hypothesized that administering n-3 PUFA supplements to children with UTIs may reduce their distressing symptoms. This study aimed to evaluate the efficacy of omega-3 supplementation in children with UTIs [7-9].

Materials and Methods

This study was a randomized, double-blind clinical trial on 100 children diagnosed with UTIs, divided equally into intervention and control groups (50 patients each). This study was conducted at Amir Kabir Hospital, Arak, Iran, between 2023 and 2024. This study included children aged 4-18 years diagnosed with UTIs based on urine analysis and culture results.

The patients were allocated to the intervention and control groups using block randomization. All patients received standard treatment for UTIs under the supervision of a pediatric infectious disease specialist for 10 days. In the intervention group, patients were administered an omega-3 capsule containing 180 mg EPA and 120 mg DHA daily for 10 days in addition to standard treatment, which included antibiotics tailored to the patient's weight, age, gender, and other relevant factors. The control group received a placebo capsule daily alongside the standard UTI treatment.

The primary outcomes evaluated included the frequency of fever, abdominal pain, dysuria, urinary frequency, and urinary incontinence. These outcomes were assessed at baseline and again after the 10-day treatment period in both groups.

This study was approved by the Ethics Committee of Arak University of Medical Sciences and registered in the Iranian Registry of Clinical Trials. Data were analyzed using SPSS software, version 23.

Results

A total of 100 children with UTI participated in this study, with a mean age of 7.8 years. A total of 75% of the patients were female, and 25% were male. No statistically significant differences were observed between the two groups in terms of mean age or gender distribution.

Baseline assessment for UTI symptoms, including fever, dysuria, urinary frequency, urinary incontinence, and abdominal pain, showed no significant differences between the intervention and control groups (Table 1).

Patients in the intervention group treated with omega-3 supplementation experienced significantly lower symptoms of dysuria and urinary frequency compared to control group. However, no significant differences were observed between the two groups regarding fever, abdominal pain, or urinary incontinence by the end of the 10-day treatment period (Table 2).

Table 1. Baseline characteristic of patients included into the study

Characteristics		Mean±SD/No. (%)		P
		Intervention Group	Control Group	
Age (y)		8.06±3.42	7.54±2.91	0.480
Gender	Female	36(72)	39(78)	0.488
	Male	14(28)	11(22)	
Fever		37(74)	33(66)	0.373
Dysuria		21(42)	27(54)	0.230
Frequency		24(48)	26(52)	0.842
Incontinency		7(14)	6(12)	0.766
Abdominal pain		38(76)	38(76)	-

Table 2. Symptoms of patients following 10 days of treatment

Outcomes	No. (%)		P
	Intervention Group	Control Group	
Fever	0(0)	0(0)	-
Dysuria	1(2)	8(16)	0.031
Frequency	2(4)	9(18)	0.025
Incontinency	3(6)	3(6)	-
Abdominal pain	4(8)	10(20)	0.084

Discussion

UTI is a common bacterial infection in children, often causing significant discomfort. Another study had investigated the impact of dietary supplements on the severity of UTI symptoms in children, with some yielding promising results. For example, one study reported that vitamin A supplementation in children with pyelonephritis infection significantly reduced symptom severity [7]. Another study highlighted the anti-inflammatory role of vitamin A, demonstrating that its administration in girls with acute pyelonephritis significantly prevented scarring caused by the infection [8]. Similarly, vitamin E supplementation has been also shown to alleviate UTI symptoms [9].

In the present study, our findings revealed that children in the intervention group who received omega-3 capsules containing 180 mg EPA and 120 mg DHA daily experienced significantly less dysuria and urinary frequency after the 10-day treatment period compared to the control group, which received a placebo alongside standard therapy. Additionally, abdominal pain was less frequent in the intervention group, although the difference was not statistically significant. The lack of significance might be attributed to the small sample size, and future studies with larger cohorts may reveal a meaningful difference.

As previously discussed, many UTI symptoms stem from the inflammatory processes associated with these infections. Effective management of these inflammatory responses can help control and improve symptoms in affected children. The reduction in symptoms observed in our study may be related to the well-documented anti-inflammatory effects of omega-3 fatty acids. For instance, one study demonstrated that fish oil supplementation in patients with urogenital inflammation inhibited the progression of inflammation [10]. In a study of Sedighi et al. on children with acute pyelonephritis, omega-3 sup-

plementation prevented scarring caused by inflammatory processes. Children treated with omega-3 had significantly better outcomes and fewer scars on follow-up DMSA scans performed six months later [11]. Similarly, Yifan Du et al. reported that fish oil reduced the risk of UTIs [12]. Another study suggested that combined supplementation with omega-3 and vitamin D reduced urinary incontinence in children [13].

The limitations of this study were the small sample size and the lack of assessment of the inflammatory markers before and after the treatment period. Future studies are recommended to evaluate these markers to better understand the mechanism of these effects of omega-3 supplementation.

Conclusion

Based on our findings, adjunctive omega-3 supplementation in children with UTIs can significantly improve symptoms after treatment. This suggests that omega-3 supplementation should be considered in children with more severe symptoms to help reduce their intensity. However, further studies are recommended to confirm these findings and provide more conclusive evidence.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Research Ethics Committee of Arak University of Medical Sciences, Arak, Iran (Code: IR.ARAKMU.REC.1402.200) and was registered in the Iranian Registry of Clinical Trials, Tehran, Iran (Code: IRCT20191104045328N22).

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Authors' contributions

Conceptualization and writing the original draft: Manijeh Kahbazi, Ali Arjmand Shabestari, Parsa Yousefichaijan, and Pegah Mohaghegh; Methodology, software, investigation, and data curation: Alireza Toghra; Validation: Arshia Toghra and Pegah Mohaghegh; Formal analysis and resources: Arshia Toghra; Review and editing: Manijeh Kahbazi.

Conflict of interest

The authors declared no conflict of interests.

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