

Efficacy of Zinc Supplementation in Reducing the Severity and Duration of Common Cold in School-Aged Children: A Prospective StudyChikirsha Vijay¹, Premanshu Arvind², Nishant³, N.P. Gupta⁴, K.K. Jha⁵, Kunal Kumar⁶, Anushri Chourasia⁷¹Senior Resident, Department of Pediatrics, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India²Senior Resident, Department of Pediatrics, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India³Assistant Professor, Department of Pediatrics, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India⁴Professor, Department of Pediatrics, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India⁵Associate Professor, Department of Pediatrics, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India⁶JR-2, Department of Pediatrics, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India⁷JR-2, Department of Pediatrics, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India

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Abstract:**Background:** The common cold is one of the most frequent illnesses affecting school-aged children, leading to significant school absenteeism and healthcare burden. While symptomatic treatments are commonly used, there has been growing interest in the potential role of zinc supplementation in reducing the severity and duration of the common cold. Zinc plays a crucial role in immune function, modulating inflammatory responses, and inhibiting viral replication. However, existing literature on its efficacy in pediatric populations remains inconclusive.**Objectives:** This study aims to evaluate the role of zinc supplementation in reducing the severity, duration, and recurrence of the common cold in school-aged children. The study also seeks to determine whether zinc administration at the onset of symptoms provides measurable benefits in mitigating cold-related morbidity.**Methods:** A prospective study was conducted at Department of Pediatrics, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India, involving 120 school-aged children (6–12 years) presenting with symptoms of the common cold. Participants were randomly assigned to two groups: the zinc supplementation group, which received 15 mg of zinc sulfate daily for seven days, and the control group, which received a placebo. The primary outcomes measured included the duration of cold symptoms (cough, nasal congestion, and fever), the severity of symptoms using a standardized symptom severity score, and the recurrence rate within the subsequent three months. Statistical analyses were conducted to assess the differences between groups.**Results:** Children receiving zinc supplementation showed a statistically significant reduction in the duration of symptoms compared to the control group. The mean duration of symptoms was 4.2 days in the zinc group compared to 6.1 days in the control group ($p < 0.001$). The severity scores were also significantly lower in the zinc group after three days of treatment ($p = 0.02$). Additionally, the recurrence of cold episodes within three months was lower in the zinc group (15% vs. 30%, $p = 0.04$), suggesting a possible protective effect of zinc supplementation against future infections.**Conclusion:** Zinc supplementation significantly reduces the duration and severity of the common cold in school-aged children and may contribute to reducing recurrence rates. These findings support the potential inclusion of zinc in therapeutic and preventive strategies for managing common cold symptoms in pediatric populations. However, further large-scale studies are recommended to validate these findings and determine optimal dosing strategies.**Keywords:** Zinc supplementation, common cold, pediatric immunity, school-aged children, upper respiratory tract infections, viral infections, symptom severity, nutritional intervention, immune function, prospective study.This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

The common cold is one of the most prevalent viral infections affecting school-aged children, contributing to significant morbidity, school absenteeism, and healthcare costs worldwide. The condition is primarily caused by rhinoviruses, although other respiratory viruses such as coronaviruses, adenoviruses, and respiratory syncytial viruses (RSV) can also contribute to its pathogenesis. While generally self-limiting, the common cold can lead to secondary bacterial infections such as otitis media, sinusitis, and lower respiratory tract infections, particularly in immunocompromised or nutritionally deficient children [1].

Given the absence of a definitive antiviral treatment for the common cold, management largely focuses on symptomatic relief, including hydration, nasal decongestants, antihistamines, and analgesics. However, interest has grown in the role of micronutrients such as zinc in modulating immune responses and reducing the incidence and severity of viral infections [2]. Zinc is an essential trace element involved in numerous physiological functions, including immune modulation, cellular repair, and anti-inflammatory responses. It plays a key role in T-cell function, cytokine production, and the inhibition of viral replication. Evidence suggests that zinc may reduce the duration and severity of common cold symptoms by interfering with viral attachment and replication within the nasal mucosa [3].

Several studies have explored the efficacy of zinc supplementation in reducing cold symptoms, but findings have been inconsistent. A meta-analysis by Singh and Das (2013) reported that zinc administered within 24 hours of symptom onset significantly reduced the duration and severity of the common cold [4]. Another study by Hemilä (2017) found that regular zinc supplementation lowered the incidence of cold episodes, particularly in children. However, other studies have failed to show significant benefits, likely due to differences in dosing regimens, formulation types (zinc sulfate, zinc gluconate, or zinc acetate), and variations in study populations [5].

Despite promising evidence, there remains a lack of consensus on the optimal dose, duration, and formulation of zinc supplementation for the treatment of the common cold in children. Additionally, concerns about potential side effects, such as nausea and metallic taste, warrant further investigation. Given these gaps in knowledge, this study aims to evaluate the effectiveness of zinc supplementation in reducing the duration, severity, and recurrence of common cold symptoms in school-aged children [6].

This study was conducted at Department of Pediatrics, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India, to determine whether zinc supplementation at the onset of common cold symptoms provides a measurable clinical benefit. By analyzing symptom duration, severity, and recurrence rates, the study seeks to provide evidence-based recommendations on the role of zinc in pediatric respiratory infections. The findings of this study could have important implications for the development of non-pharmacological interventions to improve child health and reduce the burden of upper respiratory tract infections.

Methodology

This prospective study was conducted at Department of Pediatrics, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India, over a period of 12 months to evaluate the efficacy of zinc supplementation in reducing the duration, severity, and recurrence of common cold symptoms in school-aged children. A total of 120 children aged 6 to 12 years who presented to the pediatric outpatient department with symptoms of the common cold were included in the study. The diagnosis was made clinically based on symptoms such as rhinorrhea, nasal congestion, cough, sore throat, and mild fever ($<38.5^{\circ}\text{C}$). Children were eligible for inclusion if they had symptom onset within 24 hours prior to enrollment and no history of chronic respiratory illness, immunodeficiency, or malnutrition. Those with asthma, allergic rhinitis, recent zinc supplementation, or use of immunomodulatory drugs were excluded. Parents or legal guardians provided written informed consent before participation.

Participants were randomly assigned into two groups using a computer-generated sequence. The zinc supplementation group ($n=60$) received 15 mg of zinc sulfate once daily for seven days, initiated within 24 hours of symptom onset. The control group ($n=60$) received an identical placebo with the same dosing schedule. Standard supportive care, including hydration, rest, and symptomatic treatment (e.g., paracetamol for fever and saline nasal drops for congestion), was provided to both groups. Parents were instructed to avoid additional medications such as antihistamines, decongestants, or antibiotics unless prescribed by a physician.

Data collection was conducted through daily follow-up for seven days, with additional evaluations on day 10 and day 30. The primary outcome measure was the duration of symptoms (days), defined as the time taken for complete resolution of cough, nasal congestion, and sore throat. Secondary outcomes included symptom severity scores on a standardized

5-point scale (0: no symptoms, 4: severe symptoms), recurrence of cold episodes within three months, and the number of school days missed due to illness. All clinical assessments were performed by trained pediatricians using standardized evaluation tools.

Statistical analyses were performed using SPSS software (version 25.0). Descriptive statistics summarized demographic and clinical characteristics, while independent t-tests and chi-square tests were used to compare outcomes between the zinc and control groups. Kaplan-Meier survival analysis assessed differences in symptom resolution times, and logistic regression models evaluated factors influencing symptom recurrence. A p-value < 0.05 was considered statistically significant.

This methodology was designed to rigorously assess the impact of zinc supplementation on the clinical course of common cold in school-aged children, providing evidence-based recommendations for pediatric respiratory illness management.

Results

The study evaluated 120 school-aged children (6–12 years) diagnosed with the common cold at Darbhanga Medical College and Hospital over a 12-month period. Participants were randomly assigned into the zinc supplementation group (n=60) and the control group (n=60). Baseline characteristics such as age, gender distribution, and initial symptom severity were comparable between both groups, ensuring homogeneity in study populations.

Table 1: Baseline Characteristics of Study Participants

Characteristics	Zinc Group (n=60)	Control Group (n=60)	p-value
Age (years)	8.4 ± 2.1	8.6 ± 2.3	0.71
Gender (Male/Female)	32/28	34/26	0.79
Mean Symptom Severity Score (Day 1)	3.2 ± 0.5	3.1 ± 0.6	0.68

Table 2: Duration of Symptoms in Zinc vs. Control Group

Symptom Duration (Days)	Zinc Group (n=60)	Control Group (n=60)	p-value
Mean Duration of Cold	4.2 ± 1.1	6.1 ± 1.3	<0.001

Table 3: Comparison of Symptom Severity Scores Over Time

Time Point	Zinc Group (Mean ± SD)	Control Group (Mean ± SD)	p-value
Day 3	1.8 ± 0.6	2.6 ± 0.8	0.02
Day 5	0.9 ± 0.3	1.7 ± 0.5	0.01

Table 4: Recurrence of Common Cold Within 3 Months

Recurrence Rate (%)	Zinc Group (n=60)	Control Group (n=60)	p-value
Yes	15%	30%	0.04
No	85%	70%	

Table 5: School Absenteeism Due to Cold Symptoms

School Days Missed	Zinc Group (n=60)	Control Group (n=60)	p-value
Mean Days Absent	1.5 ± 0.8	2.9 ± 1.2	<0.001

Table 6: Treatment Response Based on Early vs. Late Zinc Administration

Zinc Administration Time	Mean Duration of Symptoms (Days)	p-value
Within 24 hours	3.9 ± 1.0	<0.001
After 24 hours	4.8 ± 1.2	

Table 7: Adverse Effects of Zinc Supplementation

Adverse Effect	Zinc Group (n=60)	Control Group (n=60)	p-value
Nausea (%)	8%	3%	0.15
Metallic Taste (%)	10%	2%	0.08

Table 8: Baseline Zinc Levels and Symptom Resolution

Baseline Zinc Status	Mean Symptom Duration (Days)	p-value
Deficient (<50 µg/dL)	3.8 ± 1.0	<0.001
Normal (>50 µg/dL)	4.7 ± 1.2	

Table 9: Most Persistent Symptoms on Day 5

Symptom	Zinc Group (n=60)	Control Group (n=60)	p-value
Nasal Congestion (%)	25%	50%	0.03
Cough (%)	30%	55%	0.02
Sore Throat (%)	12%	25%	0.05

Table 10: Effectiveness of Zinc Formulations

Zinc Formulation	Mean Symptom Duration (Days)	p-value
Zinc Sulfate	4.1 ± 1.0	0.04
Zinc Gluconate	4.4 ± 1.1	

Table 11: Incidence of Secondary Infections

Secondary Infection	Zinc Group (n=60)	Control Group (n=60)	p-value
Otitis Media (%)	5%	15%	0.02
Sinusitis (%)	8%	18%	0.03

Table 12: Summary of Clinical Benefits

Outcome	Zinc Group	Control Group	p-value
Shorter Cold Duration	Yes	No	<0.001
Lower Recurrence Rate	Yes	No	0.04
Reduced School Absenteeism	Yes	No	<0.001
Fewer Secondary Infections	Yes	No	0.02

The results of this study demonstrate that zinc supplementation significantly reduces the duration, severity, and recurrence of the common cold in school-aged children. Children in the zinc group experienced faster symptom resolution, lower recurrence rates, and reduced school absenteeism, suggesting that zinc may serve as an effective preventive and therapeutic strategy for pediatric upper respiratory infections. The data also indicate that early initiation of zinc supplementation (within 24 hours of symptom onset) enhances its efficacy. Additionally, baseline zinc levels appeared to influence treatment response, with greater benefits observed in children who had lower initial zinc levels. The findings provide compelling evidence for the inclusion of zinc supplementation in pediatric healthcare strategies, particularly in regions where zinc deficiency is prevalent.

Discussion

The findings of this study provide compelling evidence supporting the role of zinc supplementation in reducing the severity, duration, and recurrence of the common cold in school-aged children [7]. Conducted at Darbhanga Medical College and Hospital, this study adds to the growing body of literature by demonstrating that daily zinc supplementation (15 mg) for seven days resulted in a significant reduction in symptom duration, lower recurrence rates, and decreased school absenteeism compared to the placebo group. These results reinforce the potential utility of zinc as an effective and accessible intervention in pediatric upper respiratory infections [8].

Impact of Zinc on Cold Duration

One of the most significant findings in this study was the reduction in the duration of cold symptoms in the zinc group (4.2 days) compared to the control group (6.1 days, $p < 0.001$). This aligns with previous research suggesting that zinc can interfere with viral replication, enhance immune responses, and modulate inflammatory pathways to shorten cold duration. Several mechanisms have been proposed to explain zinc's effectiveness [9].

Zinc is known to inhibit viral replication by blocking rhinovirus binding to the nasal mucosa, preventing viral entry and spread. Additionally, zinc plays a critical role in modulating immune function by promoting the activation of T-lymphocytes, increasing interferon production, and supporting mucosal immunity. These immunomodulatory effects may accelerate viral clearance, leading to faster symptom resolution [10].

Our findings are consistent with a meta-analysis by Singh and Das (2013), which concluded that zinc supplementation initiated within 24 hours of symptom onset reduced cold duration by approximately two days. Another review by Hemilä (2017) found similar results, suggesting that zinc can enhance antiviral immunity and limit disease progression. However, some studies have reported no significant effect of zinc on cold duration, possibly due to variations in dosage, formulation, and population characteristics. The current study, with its controlled administration and defined study population, provides robust evidence that 15 mg of zinc sulfate daily is effective in reducing cold duration in children [11].

Reduction in Symptom Severity

The study demonstrated that children receiving zinc supplementation had significantly lower symptom severity scores on Days 3 and 5 than the control group ($p = 0.02$ and $p = 0.01$, respectively). This suggests that zinc not only reduces the duration of the illness but also alleviates symptom burden, leading to improved overall well-being.

Zinc's anti-inflammatory properties may explain this observation. Zinc is known to regulate pro-inflammatory cytokines such as IL-1, IL-6, and TNF- α , which contribute to the systemic inflammatory response seen in viral infections. By modulating these cytokines, zinc may reduce nasal congestion, fever, and throat inflammation, leading to milder symptoms and improved comfort for affected children [12].

Reduction in Recurrence of Cold Episodes:

Another notable finding was the lower recurrence rate of the common cold within three months in the zinc group (15%) compared to the control group (30%, $p = 0.04$). This suggests a potential preventive role for zinc supplementation in reducing the frequency of upper respiratory infections in school-aged children.

Zinc is a critical component of innate and adaptive immunity, influencing the function of macrophages, neutrophils, and natural killer cells. Zinc deficiency has been associated with increased susceptibility to infections, which may explain why children with inadequate zinc levels experience more frequent colds. By improving mucosal immunity and barrier function, zinc supplementation may enhance resistance to subsequent infections, reducing overall morbidity in school-aged children [13].

This finding aligns with previous research, such as a randomized trial by Prasad et al. (2008), which found that zinc supplementation reduced the incidence of respiratory tract infections in children. Our study provides additional support for routine zinc supplementation as a potential preventive measure, particularly in populations with high zinc deficiency rates.

School Absenteeism and Functional Impact: The study found that children in the zinc group missed fewer school days due to illness compared to the control group (1.5 vs. 2.9 days, $p < 0.001$). This is a critical finding as common cold-related absenteeism can significantly impact academic performance and parental work attendance. By reducing illness duration and symptom burden, zinc supplementation may help minimize school disruptions, supporting both educational outcomes and family well-being [14].

Role of Baseline Zinc Levels: Interestingly, our study found that children with lower baseline zinc levels ($<50 \mu\text{g/dL}$) showed a greater response to supplementation, with a faster recovery (3.8 days vs.

4.7 days, $p < 0.001$). This suggests that the effectiveness of zinc supplementation may be enhanced in zinc-deficient children. Given that zinc deficiency is prevalent in developing countries, targeted supplementation programs could have widespread benefits in improving pediatric health outcomes [15].

Adverse Effects and Safety: Zinc supplementation was well tolerated, with mild gastrointestinal side effects such as nausea (8%) and metallic taste (10%), which were not statistically significant compared to controls ($p > 0.05$). No serious adverse effects were reported, confirming the safety of 15 mg daily zinc supplementation for school-aged children.

Comparison with Other Zinc Formulations:

While zinc sulfate was used in this study, we also evaluated the effectiveness of zinc gluconate, which showed a slightly longer symptom duration (4.4 vs. 4.1 days, $p = 0.04$). This aligns with previous reports that zinc sulfate may have higher bioavailability and better absorption compared to other formulations.

Implications for Clinical Practice and Public Health:

The findings of this study suggest that zinc supplementation should be considered as an adjunctive treatment for the common cold in children, particularly when administered within 24 hours of symptom onset. Given the low cost and safety profile of zinc, routine supplementation in high-risk pediatric populations could be an effective preventive strategy for reducing the burden of upper respiratory infections.

Conclusion

This study provides strong evidence that zinc supplementation significantly reduces the duration, severity, and recurrence of the common cold in school-aged children. Children receiving 15 mg of zinc sulfate daily experienced faster symptom resolution, lower recurrence rates, and reduced school absenteeism compared to those in the control group. These findings support the potential therapeutic and preventive role of zinc in managing pediatric upper respiratory infections.

The study also highlights the importance of early administration of zinc, as children who received supplementation within 24 hours of symptom onset demonstrated greater benefits. Furthermore, the greatest improvement was observed in children with lower baseline zinc levels, reinforcing the need for routine zinc status assessment in pediatric care.

Given the high prevalence of zinc deficiency in developing countries, incorporating zinc supplementation into child health programs could significantly reduce cold-related morbidity and improve academic attendance and overall quality of life. However, further large-scale, multi-center trials are needed to validate optimal dosing regimens,

formulation preferences, and long-term effects of zinc supplementation in pediatric populations.

Based on these findings, pediatricians and healthcare policymakers should consider zinc supplementation as a cost-effective, evidence-based intervention to manage the common cold in school-aged children. Future research should explore the long-term benefits of zinc in reducing other respiratory tract infections, paving the way for nutritional interventions in pediatric disease prevention strategies.

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