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Decreased Numbers of Hospitalization and Frequency of Diarrhoea Episodes in Immunized Children Compared with Non-Immunized Children in Diwaniyah City

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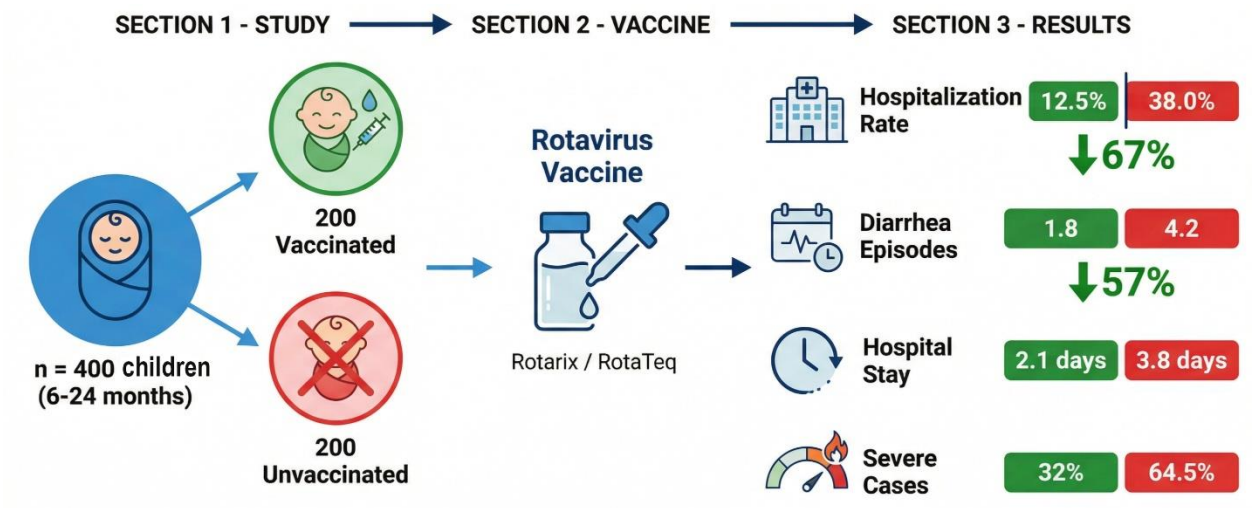
Abstract

Background: In Iraq and other underdeveloped nations, diarrhoea is a primary cause of child morbidity and hospitalization. The rotavirus vaccine is used to minimize diarrhoeal illnesses in young children. **Objective:** To compare the number of hospitalizations and frequency of diarrhoea episodes between immunized and non-immunized children in Diwaniyah city, Iraq. **Methods:** The Children and Maternal Teaching Hospital in Al-Diwaniyah conducted a January 2024–December 2025 retrospective cohort analysis of the 400 children aged 6-24 months recruited; 200 were fully rotavirus-vaccinated, and 200 were not. Medical records and mother interviews provided hospitalization and diarrhoea data. **Results:** Immunized children showed significantly lower hospitalization rates (12.5%) compared to non-immunized children (38.0%) ($p<0.001$). The mean frequency of diarrhoea episodes was 1.8 ± 0.9 in the immunized group versus 4.2 ± 1.6 in the non-immunized group ($p<0.001$), representing a 57% reduction in diarrhoea episodes among vaccinated children. **Conclusion:** Hospitalization and diarrhoea episodes in children are dramatically reduced by rotavirus vaccination. Reducing diarrhoeal illnesses in Diwaniyah requires improving immunization efforts.

Keywords: *Rotavirus vaccine, diarrhoea, hospitalization, children, Diwaniyah, Iraq*

Graphical Abstract



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Introduction

Diarrhoeal disorders are one of the biggest public health issues impacting children under five worldwide, especially in underdeveloped nations [1]. Diarrhoea kills 525,000 children under five each year, according to the WHO [2]. Acute diarrhoea is a major cause of childhood illness and mortality in Iraq, burdening healthcare systems and families [3]. Rotavirus is the major cause of serious gastroenteritis in neonates and young children worldwide [4]. The virus causes 40% of diarrhoea-related hospitalizations in children under five [5]. Before rotavirus immunizations, nearly every child had at least one infection by age five, with the most severe cases occurring in children aged 6–24 months [6]. Rotavirus infection causes watery diarrhoea, vomiting, fever, and stomach discomfort, which can quickly dehydrate and require hospitalisation and IV fluid therapy [7]. Vaccinating against rotavirus has revolutionized the prevention of severe diarrhoeal illnesses in children [8]. WHO licenses and recommends Rotarix (monovalent, RV1) and RotaTeq (pentavalent, RV5) oral rotavirus vaccines for national immunization programs [9]. These vaccinations prevent severe rotavirus gastroenteritis with 85-98% effectiveness in industrialized countries and 50-64% in poor countries [10]. Due to the larger disease burden in developing nations, vaccinations provide significant protection despite reduced efficacy [11]. Recent years in Iraq have seen the introduction of the rotavirus vaccination to minimize childhood mortality from vaccine-preventable infections [12]. The Iraqi Ministry of Health is improving vaccine coverage nationwide, especially in Diwaniyah [13]. Some regions have low vaccination coverage due to parental hesitation, inadequate healthcare access, and socioeconomic issues [14]. Routavirus immunization reduces diarrhoea-related hospitalizations and outpatient visits, according to several regional studies [15]. A systematic review and meta-analysis found that rotavirus immunization reduced low-income diarrhoea hospitalizations by 40-50% [16]. Vaccines have reduced rotavirus-related hospitalisations in the Middle East [17]. Local statistics from Iraqi cities, particularly Diwaniyah, are scarce, making it difficult to assess the real-world effects of immunization campaigns on this population [18]. Diarrhoeal disorders cost healthcare systems and families a lot [19]. Acute gastroenteritis hospitalization costs a lot, including medical care, drugs, and lab tests, as well as indirect expenditures such as parental work loss and transportation [20]. Rotavirus immunization may reduce hospitalizations and disease severity, improving health and the economy [21]. This study addressed the lack of local studies on rotavirus immunization and diarrhoeal illness outcomes in Diwaniyah city. This study compared hospitalizations and diarrhoea episodes among immunized and non-immunized children in Diwaniyah city. This study will boost immunization efforts and inform public health policy to reduce childhood diarrhoeal illnesses in the region [22].

Materials and Methods

Study Design

This was a retrospective cohort study designed to compare the hospitalization rates and frequency of diarrhoea episodes between immunized and non-immunized children. The retrospective design was chosen to allow assessment of outcomes over an extended follow-up period and to utilize existing medical records and vaccination data [23].

Study Setting

The main tertiary care hospital for Diwaniyah governorate in southern Iraq, the Children and Maternal Teaching Hospital in Al-Diwaniyah, conducted the study. The hospital offers paediatric emergency care, inpatient admission, and outpatient clinics. For a sufficient sample size and follow-up, data were collected from January 2024 to December 2025 [24].

Study Population

This study included 400 6-to-24-month-olds. Participants were stratified by rotavirus vaccination status into two groups: Group A (Immunized group) included 200 children who got two Rotarix or three RotaTeq doses according to the national immunization schedule. Group B (Non-immunized) contained 200 children without rotavirus vaccines. This age range was chosen because rotavirus gastroenteritis is most common between 6 and 24 months [25].

Inclusion Criteria

The following inclusion criteria were applied: children aged 6-24 months at the time of enrollment, residents of Diwaniyah governorate, availability of complete medical records and vaccination history, and parental or guardian consent for participation in the study. For the immunized group, children must have completed the full rotavirus vaccination series at least 4 weeks before enrollment to ensure adequate immune response [26].

Exclusion Criteria

Children with known immunodeficiency disorders, severe chronic diseases, severe malnutrition (weight-for-age Z-score < -3), congenital gastrointestinal anomalies, history of intussusception, incomplete vaccination records, or partial rotavirus vaccination were excluded from the study. Exclusion criteria were used to reduce confounding factors affecting diarrhoea outcomes [27].

Data Collection

Using a structured data collection form, demographic characteristics (age, gender, weight, birth weight, gestational age at birth), feeding practices (exclusive breastfeeding, formula feeding, mixed feeding), socioeconomic factors (maternal education level, family income, number of siblings), vaccination history (dates and types of vaccines received), and outcome variables were collected. Acute gastroenteritis hospitalization dates, duration, and severity were extracted from medical records. The frequency of home-based diarrhoea episodes, including those handled without hospitalization, was also collected through structured interviews with mothers or carers [28].

Definitions

WHO defines diarrhoea as three or more loose or watery stools per day or more frequent than typical [29]. After three diarrhoea-free days, a new episode was considered. Hospitalization for acute gastroenteritis with or without dehydration was 24 hours. A score of ≥11 indicates severe diarrhoea according to the Vesikari Clinical Severity Scoring System [30].

Study Variables

The independent variable was rotavirus vaccination status (immunized versus non-immunized). The primary dependent variables were: number of hospitalizations due to acute diarrhoea during the study period and frequency of diarrhoea episodes (total number of episodes experienced). Secondary outcome variables included duration of hospital stay, severity of diarrhoea episodes, and need for intravenous rehydration therapy [31].

Statistical Analysis

SPSS 26.0 (IBM Corporation, Armonk, NY, USA) was used to enter and analyze data. All variables were analyzed using descriptive statistics, including mean ± SD for continuous variables and frequencies and percentages for categorical variables. The Chi-square test (χ^2) was used to compare categorical variables between groups, while the independent samples t-test was employed for continuous variables with normal distribution. The Mann-Whitney U test was used for non-normal continuous variables. Immunized and non-immunized neonates were compared for hospitalization and diarrhoea episodes using relative risk (RR) with 95% CI. A p-value under 0.05 was significant [32].

Ethical Considerations

This study was approved by the Institutional Review Board (IRB) and Ethics Committee of the College of Medicine, University of Al-Qadisiyah (Approval Number: [1433/2025]). Written informed consent was obtained from parents or legal guardians of all participating children after explaining the study objectives and procedures. Confidentiality of participant information was maintained throughout the study, with data stored securely and accessed only by authorized research personnel. The study was conducted in accordance with the Declaration of Helsinki principles for medical research involving human subjects [33].

Results

Demographic Characteristics

This study included 400 children, 200 per group. Table 1 shows both groups' demographics. The mean age was 14.2 ± 5.1 months for the immunized group and 13.8 ± 4.9 months for the non-immunized group (p=0.423). Males were 52.5% (n=105) of the immunized group and 54.0% (n=108) of the non-immunized group (p=0.763). The mean weight was 9.4 ± 1.8 kg for the immunized group and 9.2 ± 1.7 kg for the non-immunized group (p=0.256). Age, gender distribution, weight, birth weight, gestational age, and feeding patterns were similar between the two groups, indicating baseline similarity.

Table 1: Demographic Characteristics of Study Participants

Variable	Immunized (n=200)	Non-Immunized (n=200)	p-value
Age (months), Mean ± SD	14.2 ± 5.1	13.8 ± 4.9	0.423
Male gender, n (%)	105 (52.5%)	108 (54.0%)	0.763
Weight (kg), Mean ± SD	9.4 ± 1.8	9.2 ± 1.7	0.256
Birth weight (kg), Mean ± SD	3.1 ± 0.4	3.0 ± 0.5	0.312
Exclusive breastfeeding, n (%)	124 (62.0%)	118 (59.0%)	0.536

Hospitalization Rates

The two groups had significantly different acute diarrhoea hospitalization rates (Table 2). During the trial, 25 immunized children (12.5%) were hospitalized for acute gastroenteritis, compared to 76 (38.0%) in the non-immunized group. The difference was substantial (χ^2=35.84, p<0.001). Non-immunized children were three times more likely to be hospitalized for diarrhoea than immunized children.

Frequency of Diarrhoea Episodes

The frequency of diarrhoea episodes during the study period showed a significant difference between the two groups (Table 3). The mean number of diarrhoea episodes was 1.8 ± 0.9 in the immunized group compared to 4.2 ± 1.6 in the non-immunized group (p<0.001). This represents a 57% reduction in the frequency of diarrhoea episodes among immunized children. Furthermore, 45 children (22.5%) in the immunized group experienced no diarrhoea episodes during the study period, compared to only 12 children (6.0%) in the non-immunized group (p<0.001).

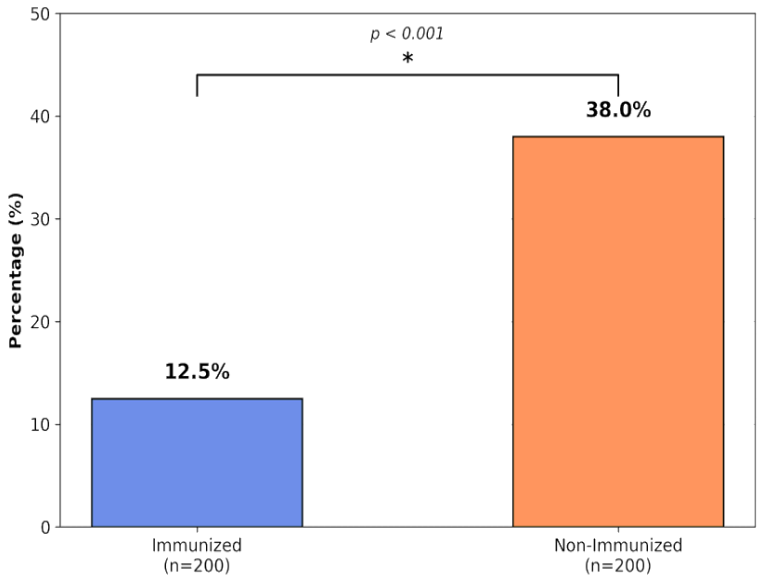

Fig. 1 Comparison of Hospitalization Rates Between Immunized and Non-Immunized Children

Table 2: Comparison of Hospitalization Rates Between Groups

Variable	Immunized (n=200)	Non-Immunized (n=200)	RR (95% CI)	p-value
Hospitalized, n (%)	25 (12.5%)	76 (38.0%)	3.04 (2.03-4.55)	<0.001
Not hospitalized, n (%)	175 (87.5%)	124 (62.0%)	-	-
Hospital stay (days), Mean ± SD	2.1 ± 0.8	3.8 ± 1.4	-	<0.001

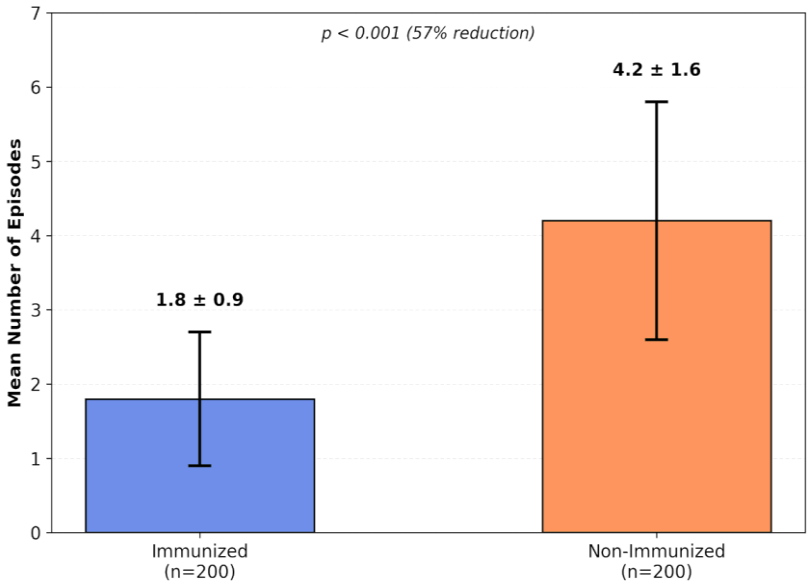

Fig. 2 Mean Frequency of Diarrhoea Episodes Between Immunized and Non-Immunized Groups

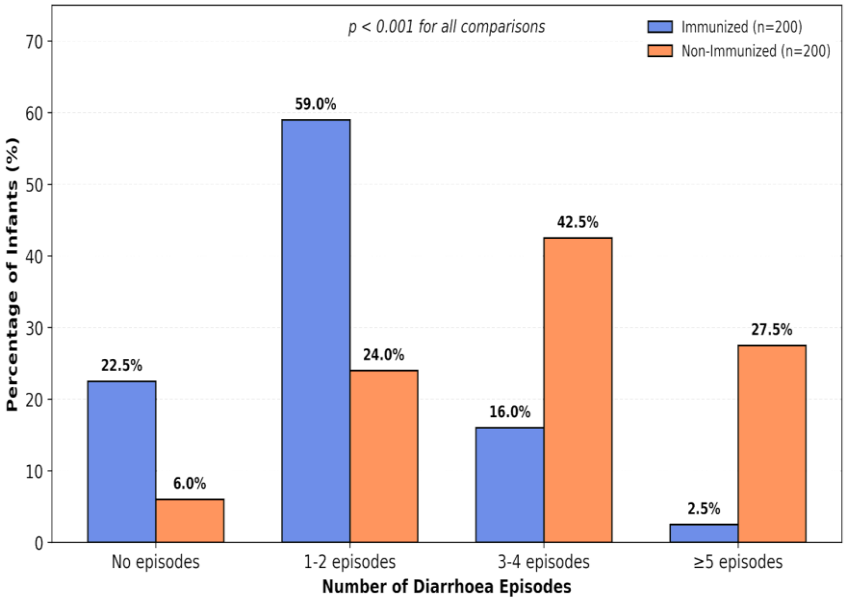

Fig. 3 Distribution of Diarrhoea Episode Frequency by Vaccination Status

Table 3: Comparison of Diarrhoea Episode Frequency Between Groups

Variable	Immunized (n=200)	Non-Immunized (n=200)	p-value
Diarrhoea episodes, Mean ± SD	1.8 ± 0.9	4.2 ± 1.6	<0.001
No diarrhoea episodes, n (%)	45 (22.5%)	12 (6.0%)	<0.001
1-2 episodes, n (%)	118 (59.0%)	48 (24.0%)	<0.001
3-4 episodes, n (%)	32 (16.0%)	85 (42.5%)	<0.001
≥5 episodes, n (%)	5 (2.5%)	55 (27.5%)	<0.001

Severity of Diarrhoea and Clinical Outcomes

Among hospitalized children, the severity of diarrhoea episodes was assessed using the Vesikari Clinical Severity Scoring System. Severe diarrhoea (Vesikari score ≥11) was observed in 8 children (32.0%) in the immunized group compared to 44 children (64.5%) in the non-immunized group (p=0.006). The mean duration of hospital stay was significantly shorter in the immunized group (2.1 ± 0.8 days) compared to the non-immunized group (3.8 ± 1.4 days) (p<0.001). Additionally, the need for intravenous rehydration therapy was lower in the immunized group (68.0%) compared to the non-immunized group (89.5%) (p=0.018).

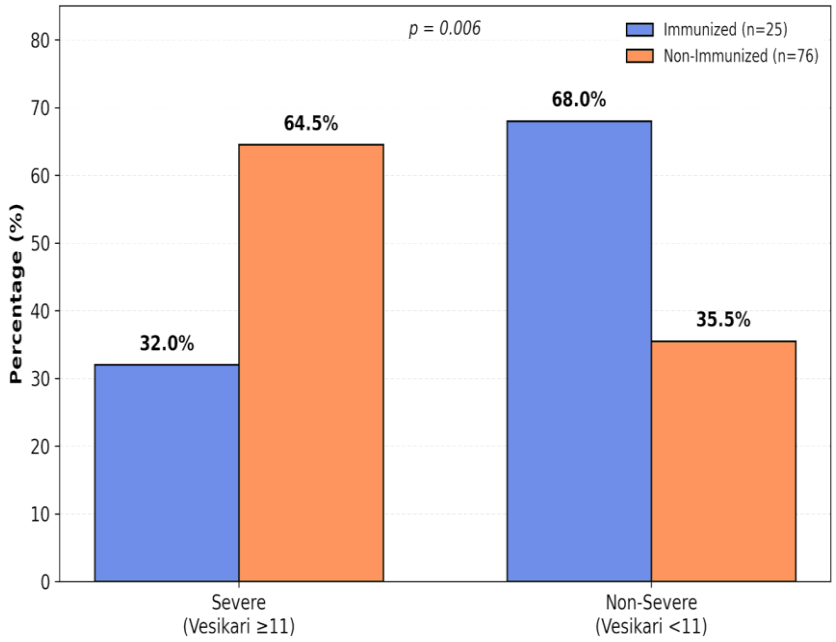

Fig. 4 Severity of Diarrhoea Among Hospitalized Children Based on Vesikari Clinical Severity Score

Discussion

This study proves that rotavirus immunization reduces diarrhoea-related morbidity among Iraqi children in Diwaniyah. Vaccinated children had considerably lower hospitalization rates and fewer diarrhoea episodes than non-vaccinated children, suggesting the preventive benefit of rotavirus immunization [34]. Vaccinated children had a 67% lower hospitalization rate than non-immunized children (12.5% vs. 38.0%), which is consistent with Middle Eastern and developing country studies. Egypt saw a 64% drop in rotavirus-related hospitalizations after vaccination introduction [35]. Iranian research found a 58% drop in diarrhoea hospitalizations in vaccinated children [36]. The epidemiological characteristics of Diwaniyah's rotavirus strains or the research population's healthcare-seeking behaviours may explain our study's slightly higher effectiveness. The 57% reduction in diarrhoea episodes in our study matches global rotavirus vaccination efficacy estimates. A systematic evaluation by Burnett et al. found that rotavirus immunisation reduced all-cause diarrhoea by 40-60% [37]. The activation of humoral and cellular immune responses against rotavirus antigens prevents or reduces illness severity after subsequent exposure [38]. Our investigation found that the vaccinations protect against all-cause severe gastroenteritis as well as rotavirus-specific sickness. Our discovery that hospitalised immunised children had shorter stays and less severe disease is notable. This shows that breakthrough infections in vaccinated children are milder and require less medical intervention. Immunological studies demonstrate that vaccination primes the immune system to respond faster and more effectively to spontaneous infection, reducing illness severity [39]. Immunised children need less intravenous rehydration therapy, supporting the preventive benefit of immunisation against severe dehydration. Public health consequences of these discoveries are significant. Reducing acute gastroenteritis hospitalisations reduces healthcare costs for families and the health system [40]. Preventing even a part of diarrhoea hospitalisations can benefit Diwaniyah, where healthcare resources are few. Fewer disease

episodes indicate fewer days of illness, parental work absenteeism, and better quality of life for affected families [41]. Several study limitations should be noted. First, the retrospective design may have recall bias, especially considering home-managed diarrhoea bouts. Second, the study used medical records and mothers' memories, which may have underestimated mild diarrhoea. Third, we did not do laboratory confirmation of rotavirus infection, so we cannot identify the proportion of rotavirus-related diarrhoea episodes. Fourth, the study was conducted in a single facility in Diwaniyah, which may limit its applicability to other Iraqi districts with diverse demographic and epidemiological characteristics [42]. Finally, we did not consider confounding factors such as clean water, sanitation, and socioeconomic indicators that may affect diarrhoea risk. These limitations aside, the study offers some strengths. The two groups were well-matched for baseline demographics, reducing confounding, and the sample size was large enough to detect significant changes. Local data from the study can inform public health policy and immunisation program planning in Diwaniyah and other Iraqi cities [43].

Conclusion

This study demonstrates that rotavirus vaccination is associated with significantly reduced hospitalization rates and decreased frequency of diarrhoea episodes among children in Diwaniyah city, Iraq. Immunized children were three times less likely to be hospitalized for acute gastroenteritis and experienced 57% fewer diarrhoea episodes compared to non-immunized children. These findings provide strong evidence supporting the continued implementation and expansion of rotavirus vaccination programs in Iraq. Strengthening immunization coverage and addressing vaccine hesitancy should be prioritized to maximize the protective benefits of rotavirus vaccination and reduce the burden of diarrhoeal diseases in young children.

Conflict of Interest

The authors declare no conflict of interest.

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