

**Updates in the Prevalence of Rotavirus Gastroenteritis in Babylon City
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Abstract:

Background: Diarrhea is a main cause of morbidity and mortality in children under 5 years old. Globally it is responsible for approximately four billion cases and three million deaths annually. In developing countries, it causes two million deaths each year. The major causative organism is rotavirus which is responsible for one-third of hospitalizations with approximately 40% mortality.

Objectives: To determine the prevalence and demographic characteristics of rotavirus infection in Babylon city, Iraq.

Materials and Methods: Fecal samples were taken from children with age range of 6 months to 5 years complained of diarrhea during the period beginning in October 2016 till August 2017. The age, gender, residence, the type of feeding, place of the sample collection and duration of diarrhea were recorded. Specimens were analyzed by Latex test for detection of rotavirus.

Results: A total of 349 children presented with diarrhea, the rotavirus antigen was detected in 169 fecal specimens from children with diarrhea (48%). More percentages of positive rotavirus specimens were seen in the 5year of age. No gender differences were observed, meanwhile samples obtained from rural areas and breastfed children showed less rotavirus positive infection.

Conclusion: The present study confirms that rotavirus infection is still currently a prevalent gastroenteritis causative agent and required careful clinical attention. Pediatricians and health care providers are needed to be encouraged to take into account the children who at risk for developing rotavirus infection including age, residence and type of feeding.

Key words: Rotavirus Gastroenteritis, Babylon province-IRAQ

التحديثات في أنتشار التهاب الامعاء الناتج من الاصابة بفايروس الروتا في مدينة بابل

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الخلاصة:

المقدمة: يمثل الإسهال سبب رئيسي للوفاة واعتلال الصحة للأطفال دون سن الخامسة في مختلف دول العالم، حيث أنه يسبب حوالي أربع مليارات حالة إصابة وثلاثة ملايين حالة وفاة سنويا منها مليوني حالة وفاة في الدول النامية. فيروس الروتا هو مسؤول عن ثلث حالات الإسهال التي تستوجب الدخول في المستشفيات وتسبب وفيات بنسبة 40%. الهدف: تحديد مدى أنتشار فيروس الروتا والصفات الديموغرافية المتعلقة بالإصابة به في مدينة بابل في العراق المرضى والعمل: عينات من خائط الأطفال المصابين بالإسهال بعمر من 6 أشهر الى 5 سنوات تم الحصول عليها بصورة عشوائية للفترة من تشرين أول 2016 الى اب 2017. تم تسجيل العمر، الجنس، السكن، نوع التغذية، مكان جمع العينة وطول فترة الإسهال. عينات المرضى تم الكشف عن فايروس الروتا فيها عن طريق اختبار الكشف المطاطي النتائج: من مجموع المرضى الكلي البالغ 349 مريضا مصاب بالإسهال، تم الكشف عن وجود فايروس الروتا في خائط 169 مريضا (48%). النسبة الأكبر للمرضى المصابين بالروتا كانت في عمر الخمس سنوات ولم يكن فرق بين الجنسين. العينات التي أخذت من المناطق الريفية ومن الأطفال الذين يتغذون على حليب الأم كانت تمثل نسبة أقل من الإصابة بالفايروس الاستنتاج: الدراسة الحالية تؤكد أن الإصابة بفايروس الروتا لا زال يمثل نسبة كبيرة من الاطفال المصابين بالإسهال والتي تستوجب الانتباه لها سريريا. اطباء الاطفال والعاملين في الرعاية الصحية الاولية يجب أن يأخذوا بنظر الاعتبار احتمالية الإصابة بفايروس الروتا في أي حالة من حالات الإسهال التي يواجهونها مع الاعتبار بالعمر والسكن ونوع التغذية.

الكلمات المفتاحية: الالتهاب المعوي الحاد وروتا فايروس

Introduction:

Rotavirus infection is the most significant cause of acute gastroenteritis in children worldwide (1). Each year, it causes more than 150 million episodes of diarrhea that require medical care and more than 500,000 deaths in children younger than 5 years (2). In Iraq, rotavirus infection was confirmed in (24-37%) of children with acute gastroenteritis (3, 4).

The pathology of viral infection involves its attachment to the mature villi in the epithelial cells of the small intestine, and the disease usually presented clinically in the ranges from transient, mild diarrhea to severe episodes of acute fever, vomiting, and watery diarrhea in the infected children. The major sequelae of rotavirus infection are dehydration and electrolyte disturbances which commonly occur in the youngest children.

Improving personal hygiene and living standards have been found inadequate to decrease the risk of developing diarrhea in children especially in developing countries. Therefore, development of effective and safe vaccine became a priority in order to significantly reduce this disease outcome in form of health-care attendance, hospitalization or even death. In published data, available licensed rotavirus vaccines appear to be safe and well-tolerated (5, 6). They provide 80-100% protection against rotavirus infection

in Europe, Japan and USA (7-9). Whereas in developing countries, effectiveness of rotavirus vaccines showed a huge heterogeneity in the results (20-60%) which is in general much less than in developed countries (10).

Analyzing the effect of vaccination in early adopter countries is a great challenge for policy makers worldwide and it is rather essential to assess if the benefits compensate the costs and support wider propagation of these vaccines. In developing countries, rotavirus vaccines remain to be fully evaluated due to reduced difficulties in reaching target populations, greater strain diversity and immunogenicity of oral vaccines which might decrease immunization program performance. In Iraq, rotavirus vaccine (Rotarix®) has been introduced into the national immunization programmed since 2012 and subsequently no survey has been done to evaluate its effectiveness. The Iraqi ministry of health calls for studies to be taken in order to estimate the effectiveness of the vaccine and this is the aim of the current and future research.

Patients and Methods

Patients:

A cross sectional study was conducted at Babylon teaching hospital for maternity and children in addition to three major primary health centers in Babylon city. A

total of 349 children presented acute diarrhea have been collected at time of study application during the period from the 1st of October 2016 to the 1st of August 2017. Information including age, sex, residence, type of feeding, and clinical features (diarrhea, fever, vomiting and degree of dehydration) were taken according to the WHO criteria. The objectives and methodology of this study were explained to all parents or guardians of the patients in the study to gain their verbal consent.

All vaccinated children presented with acute diarrhea from the age of 6 months to the age of 5 years were included in this study, except for the following exclusions:

- (1) Infant younger than 6 months.
- (2) Children older than 5 years.
- (3) Hypersensitivity to (Rotarix®)vaccine.
- (4) Gastrointestinal Tract Congenital Malformation.
- (5) History of Intussusception.
- (6) Severe Combined Immunodeficiency Disease.

Methods

Latex test for human Rotavirus Antigen (LA): The method was performed by using

the commercial latex agglutination kit (Blasmatec, Germany). The test was considered positive for rotavirus if distinct agglutination was observed with test latex but not with control latex and indeterminate if agglutination was observed in test and control latex, this test was performed according to the manufacturer's specifications(11).

Data Analysis: Statistical analysis was carried out using SPSS version 17. Categorical variables were presented as frequencies and percentages. Pearson's chi square (χ^2) and Fisher-exact test were used to find the association between categorical variables. A P-value of ≤ 0.05 was considered as significant.

Results

Prevalence of rotavirus:

A total number of 349 children were involved in the study; the rotavirus antigen was detected in 169 fecal specimens from children presented with diarrhoea. This gives overall prevalence of rotavirus gastroenteritis of 48%, as illustrated in Figure (1).

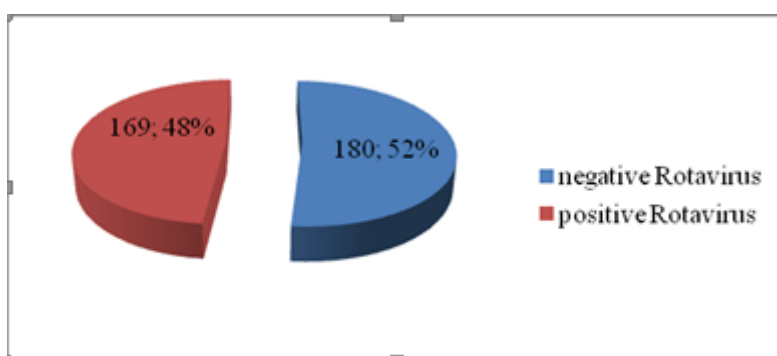


Figure (1): Prevalence of rotavirus infection.

The prevalence of rotavirus gastroenteritis was assessed according to demographic

and disease characteristics of children (Table 1) as follows:

Table (1): Prevalence of rotavirus infection according to demographic and disease characteristics.

Variables	(Negative RV)	(Positive RV)	P-value	
Number	180	169		
Age (months)	21.5 ± 13.7	18.9 ± 13.1	0.072 NS	
Age groups	n (%)	n (%)	0.066 NS	
6 – 12 months	57 (45.6%)	68 (54.4%)		
13 – 24 months (1-2year)	58 (52.3%)	53 (47.7%)		
25 – 36 months (2-3 years)	28 (60.9%)	18 (39.1%)		
37 – 48 months (3-4 years)	21 (53.8%)	18 (46.2%)		
49 – 60 months (4-5 years)	16 (57.1%)	12 (42.9%)		
Gender,	n (%)	n (%)	0.689 NS	
Female	88 (52.7%)	79 (47.3%)		
Male	92 (50.5%)	90 (49.5%)		
Residence			0.183 NS	
Rural	83 (55.7%)	66 (44.3%)		
Urban	97 (48.5%)	103 (51.5%)		
Sample collection			0.006**	
Hospital	135 (51.3%)	128 (48.7%)		
Clinic	12 (32.4%)	25 (67.6%)		
Primary care center	33 (67.3%)	16 (32.7%)		
Type of feeding			0.564 NS	
Artificial	58 (47.2%)	65 (52.8%)		
Breast	59 (56.2%)	46 (43.8%)		
Food	24 (54.5%)	20 (45.5%)		
Mixed	39 (50.6%)	38 (49.4%)		
Duration of Diarrhea(Days)				
Negative	Positive	OR	95% CI of OR	P value
4.1 ± 1.3	3.8 ± 1.3	0.846	0.719 – 0.996	0.045*

Data presented as mean ± SD,

Number of patients (n) and percentage (%)

Independent t-test used, Chi-square test (using linear by linear association) after correction using Monte Carlo methods of asymmetrical p-value, Binary logistic regression, OR: odd ratio. CI: confidence interval

NS is considered nonsignificant, * P value < 0.05 (significant), **P value < 0.01(highly significant)

Prevalence Rotavirus Gastroenteritis According to Age

The results illustrated in Table (1) and

Figures (2) showed that the prevalence of positive infection with rotavirus was optimum (54.4%)in age groups between 6 –12 months compared to other age groups, and the prevalence of negative infection with rotavirus was optimum (60.9%)in age groups between 25 –36 months compared to other age groups, though no significant difference was seen according to the children age in respect to the infection whether positive or negative rotavirus (P value > 0.05).

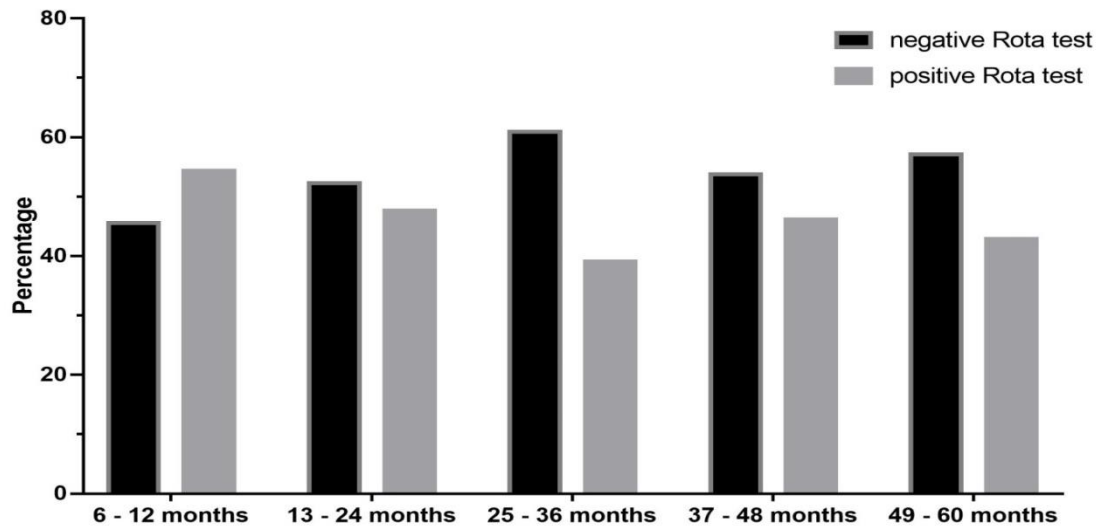


Figure (2): Prevalence of rotavirus infection according to age groups

Moreover, the association between risk of positive rotavirus infection in children with age groups between 6 – 12 months was the highest, followed by age group 13 –24 months, age group 37 – 48 months, and then 49-60 months respectively. Meanwhile

age group of 25 – 36 months had the highest association with a negative rotavirus infection, however, all these relationships did not reach statistical significance ($P > 0.05$), as illustrated in Table (2), Figure(3).

Table (2): Association between risk of positive rotavirus infection according to age groups

Age groups	OR	95%CI of OR	P value
6 – 12 months	1.591	0.696 – 3.637	0.271
13 – 24 months	1.218	0.528 – 2.811	0.643
25 – 36 months	0.857	0.330 – 2.226	0.752
37 – 48 months	1.143	0.430 – 3.039	0.789
49 – 60 months	Reference		

Binary logistic regression analysis
OR: odd ratio. CI: confidence interval

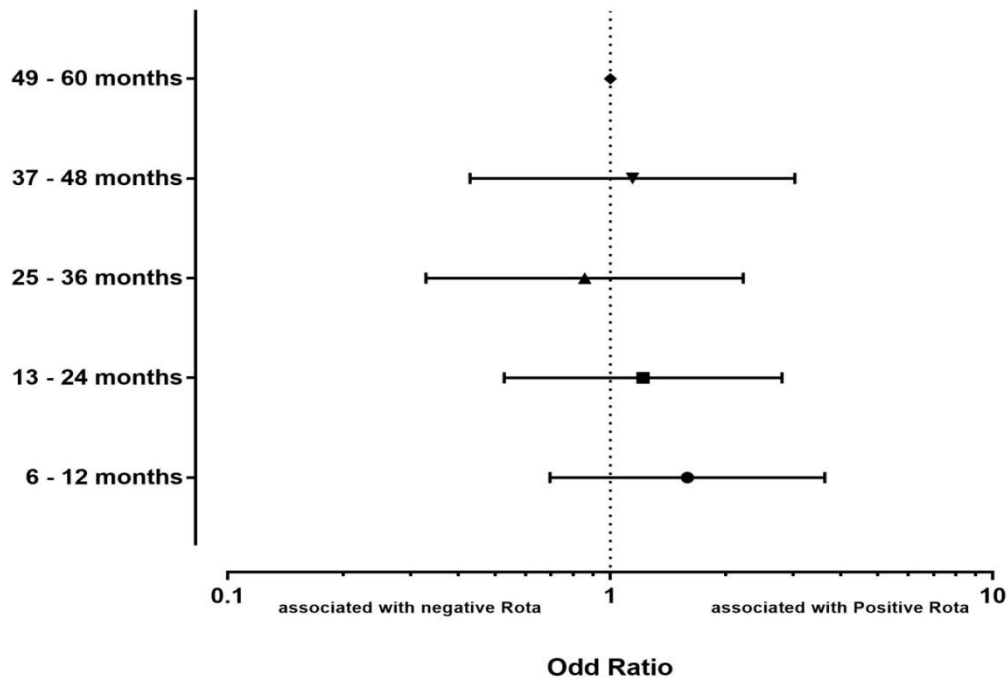


Figure (3): Association between risk of positive rotavirus infection according to age groups

Prevalence Rotavirus Gastroenteritis According to Gender

As illustrated in Table (1) and Figure (4), there was no significant difference

($P > 0.05$) in the gender of the children with positive or negative rotavirus infection.

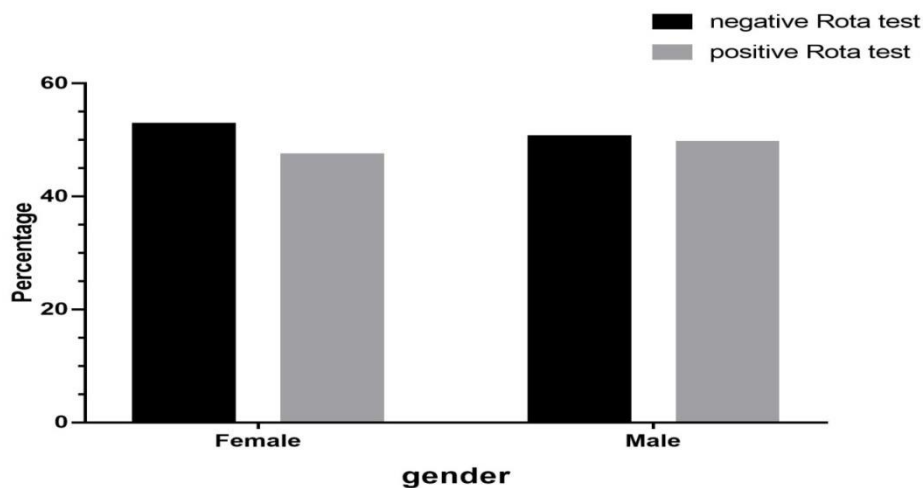


Figure (4): Prevalence of rotavirus infection according to age groups gender

Prevalence Rotavirus Gastroenteritis According to Residence

There was no significant difference ($P > 0.05$) in the residence in children with positive or negative rotavirus infection as illustrated in Table (1) and Figure (5).

However, rural area has been associated with less prevalence of positive rotavirus infection (44.3%) than in urban for positive infection (51.5%).The opposite percent was noticed in cases of negative rotavirus infection.

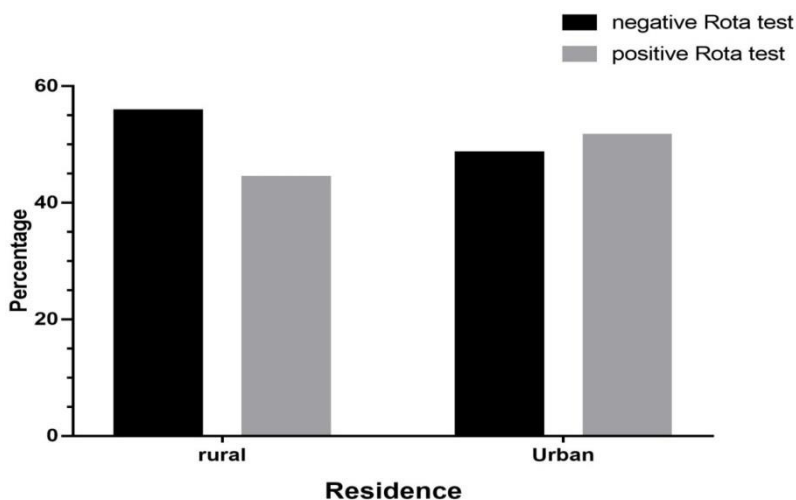


Figure (5): Prevalence of rotavirus infection according to residence

Prevalence Rotavirus Gastroenteritis According to Place of Sample Collection

The results presented overall high significant difference in samples collection areas between positive and negative rotavirus infection ($P < 0.01$). Children

with positive rotavirus infection were more prevalent when sample collected from private clinics (67.6%) and less from primary care centers (32.7%) compared to negative rotavirus infection children, (Table 1) and (Figure 6).

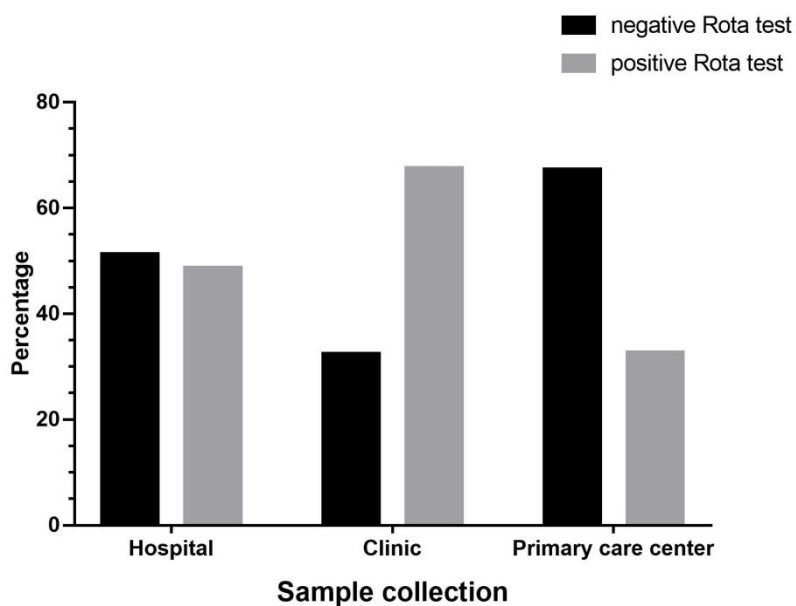


Figure (6): Prevalence of rotavirus infection according to place of sample collection

Prevalence Rotavirus Gastroenteritis According to Type of Feeding

Children on breast feeding presented with the least positive cases of rotavirus infection(43.8%) and the peak positive cases in negative cases for rotavirus

infection (56.2%).However, overall there was no difference($P > 0.05$) among children with negative or positive rotavirus infection in respect to different types of feeding. The results illustrated in Table (1) and Figure (7).

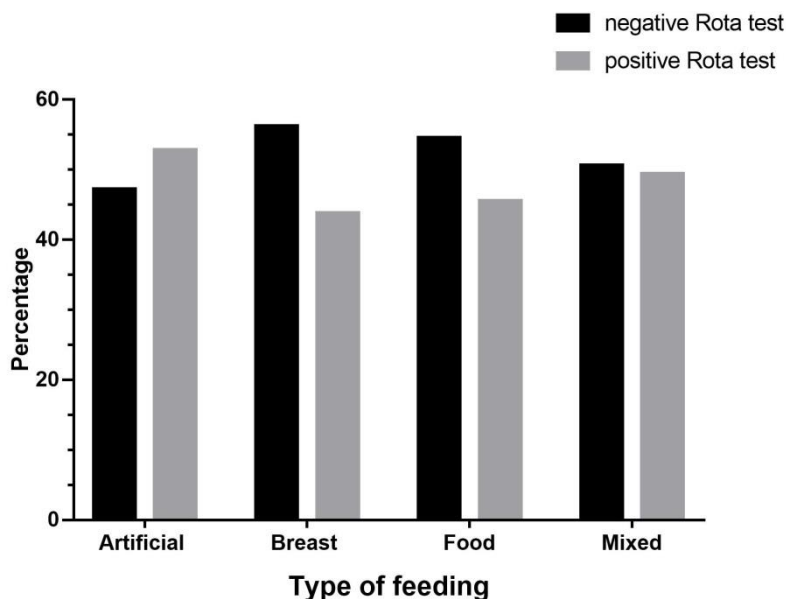


Figure (7): Prevalence of rotavirus infection according to type of feeding

Prevalence Rotavirus Gastroenteritis According to Duration of diarrhea

There was a significant negative correlation between duration of diarrhea

and positive rotavirus infection ($P < 0.05$) (i.e., a longer duration of diarrhea predict negative rotavirus infection), (Table 1) and (Figure 8).

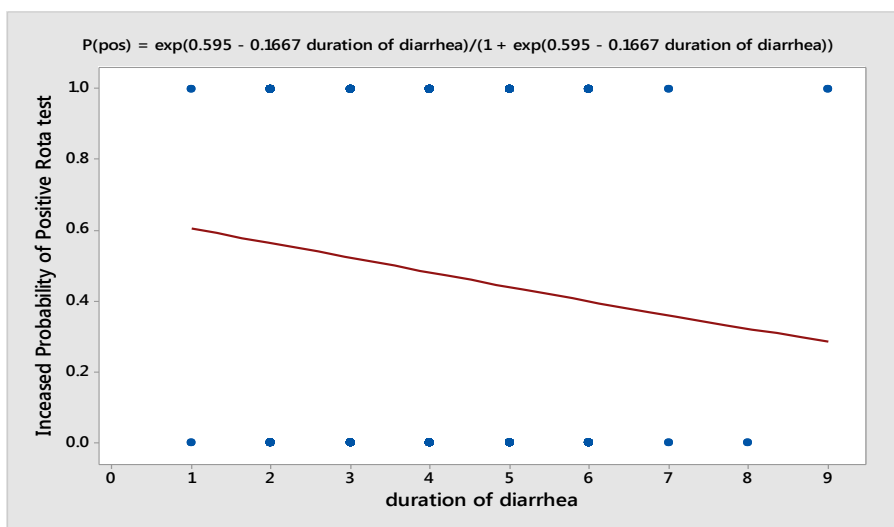


Figure (8): Probability plot of the inverse correlation between duration of diarrhea and positive rotavirus infection.

Discussion

Diarrheal diseases in children are a major public health concern in developing countries, including Iraq. Viruses cause about 70% of episodes of acute infectious diarrhea in the pediatric age group (12). Rotavirus infection is endemic worldwide especially in the first few years of life; and usually correlated with high rates of

morbidity and mortality in developing countries due to poor nutrition and health care (13).

The present results showed that the prevalence of rotavirus infection in Babylon city is 48%, while few local previous studies done after the introduction of rotavirus vaccine have demonstrated variable prevalence rates like: like 56% in

2011 (14), 45% in 2012 (15) and 50% in 2013 (16) all were done in Babylon, also 25% in 2013 in Baghdad, 22% in 2016 in Sulaimani, and 39% in 2012 in Anbar (17-20). Such findings indicated that high prevalence of rotavirus infection is continued in Babylon province comparing to Baghdad and northern cities where it's remained low probably due to geographical and water source effects. This is needed to be clarified using a national multi-central study involves multiple cities and regions in Iraq at the same time for a considerable period of time.

Within the diarrhea groups, the highest prevalence was seen in children from 6 to 12 months of age than other age groups and the prevalence declines as the child grow-up. These findings were observed in Ali *et al*, 2010 (21), Al-Ameen *et al*, 2012 (22) and Al-Sayidi *et al*, 2014 (17), probably because at this age feeding starts and children started to put things in their mouths. Older children showed the lower percentages of rotavirus infection probably due to acquired protective immunity during previous exposures to rotavirus which rendered them more resistant to infection with rotavirus. In developing countries, severe rotavirus gastroenteritis is mainly restricted to children aged 6–24 months. Additionally, (75%) of children suffer their first rotavirus diarrhea episode before age of 12 months (23). Children younger than 6 months of age are not included in this study because they are beyond the age of vaccination scheme and the presence of rotavirus in their stool may be contributed to the shedding of the virus vaccine rather than due to true infection. Additionally, infants at this age may acquire passive immunity from their mothers which gradually declines after 6 months.

Males were tending to be more effected by rotavirus in compares to females. Statistically, gender differences were not significant ($p>0.05$). These male predominate in the present study was in agreement with the results of some local

studies (17, 21), and some regional neighboring countries (23-25). Other study had found a relation between the risk of rotavirus diarrhea and male gender in addition to other factors such as poor education level (18).

In the current study, rural area has been associated with fewer incidences in positive rotavirus infection, though no significant difference compared to urban area. Similar results were obtained from Salih, 2009 (26), Al-Nasrawi, 2011 (27) and Hasan, 2011 (28).

Most of the samples which was with positive rotavirus infection in this study were collected from hospitals then private clinics and lastly from primary health centers which indicated that less numbers of children with diarrhea visited primary health centers in comparison to those who visited hospitals. This probably attributed to the severity of diarrheal symptoms that necessity direct hospital admission rather than to the primary health centers.

The type of feedings has potential effect on the prevalence of positive cases, such that less positive cases of rotavirus infection were seen in breast feeding children than other types of feedings. On the other hand, artificial feeding presented with higher percentages of positive rotavirus infection. Similar findings were described by Al-Dahmoshi *et al*, 2013 (16), Ali *et al*, 2010 (21) and Das *et al*, 2016 (29) which may reflect that breast-fed children acquired maternal immunoglobulin antibodies against infection from their mothers. Nevertheless, it can be speculated that breastfeeding does not appear to diminish immune response to rotavirus vaccine since infants who are being breastfed should be vaccinated on schedule Also infants living in households with pregnant women should be vaccinated according to the same schedule as infants in households without pregnant women.

Clinical course of diarrheal diseases is of highest importance in prediction of the causative agents. The current findings predict a negative correlation between the

extent of the duration of diarrhea and presence of rotavirus infection i.e. short duration of diarrhea 1-4 days is highly suggested of positive rotavirus infection while prolong duration of diarrhea more than 5 days is more likely to be of negative rotavirus infection. These observations were also agreed by Alkali *et al*, 2015 (30) and Junaid *et al*, 2011 in respect to the clinical course of diarrheal diseases (13). In conclusion, our findings indicated that the prevalence of rotavirus gastroenteritis remains high after five years of introducing rotavirus vaccine in the Iraqi national immunization program.

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