



## Review of Rotavirus Epidemiology in Iraq

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### Abstract

Rota virus is a member of *Reoviridae* that have double strand RNA and considered as a major important etiology which caused diarrhea illnesses in children and infants below 5 years old.<sup>[1]</sup> it was estimated that every child around the globe is affected by a rotavirus at least once in his early childhood.<sup>[2]</sup> with each infection Immunity develops, that results in decreasing the severity of subsequent infections; adults seldom affected.<sup>[3]</sup> the genus had nine species, A, B, C, D, E, F, G, H and I. *Rotavirus A*, is the commonest, causing greater than 90% of rotavirus infections in humans.

**Key words :-** Rotavirus, chlidten, ELISA ,epidemiology, Gastroenteritis

### Introduction

Acute Gastroenteritis remains a common illness among infants and children throughout the world, among children in the United States acute diarrhea accounts for > 1.5 million outpatient visits, 200.000 hospitalizations, and approximately 300 deaths /year while in developing countries diarrhea is a common cause of mortality among children aged < 5 years with an estimated 2 million deaths annually [1]. Acute diarrhea is defined as a diarrheal illness lasting for less than 2 weeks, if the illness persists for more than 2 weeks it was considered chronic diarrhea. Most of infectious diarrhea acquired through the feco-oral route by way of food or water contamination, and the most common causes among infectious agents are Viruses [e.g Rotavirus, Calici virus, Norwalk virus, Astro virus, Enteric adenovirus] [2] Rotavirus infecting human worldwide, The virus is a leading cause of death among infants and children under 5 years old [3]. Three to five percent of all hospitalization of children under age 5 are caused by Rotavirus [4]. In susceptible persons, primarily infants and young children who have not yet developed immunity, Rotavirus infects the cells of the small intestine, producing an enterotoxin that can cause gastroenteritis and severe diarrhea which can cause dehydration, possibly leading to death [5] There are seven species of Rotavirus which are called A,B,C,D,E,F and G. The A species makes the main species, consist of different strains called serotypes. The Rotavirus A species responsible for the infection in human, spread via the feco-oral rout, and a large

number of the virus are excreted by infected children [6]. Rotavirus is highly infectious because the virus has a triple-layered protein coat and is very stable, allowing it to survive outside of the body [7]. It is not only infects human but also infect animals as with influenza and the infected animal acts as a reservoir for new strains of mutated Rotavirus that could cause epidemic [8]. The seasonal variation of Rotavirus A infections in Iraq peaks during the winter months. The virus causes millions of diarrhea cases in Iraq and accounts of more than 90% of Rotavirus gastroenteritis in human and is endemic world wide per each year [5]. In temperate areas, Rotavirus infections occur primarily in the winter where as in the tropics they occur throughout the year, the difference is partly explained by seasonal changes in temperature and humidity, the number attributable to food contamination is unknown [9]. Rotavirus gastroenteritis is a mild to severe disease characterized by vomiting, watery diarrhea, low-grade fever. There is an incubation period of about two days before symptoms appear [10] Infection rarely cause other complication in the well managed child [11] There are reports in the literature of rare complication involving the central nervous system (CNS) where rotavirus was detected in the fluid of the CNS in cases of encephalitis and meningitis [12,14] but these complication are uncommon even in developing countries repeated rotavirus infections may increase the risk of celiac disease in genetically susceptible children. A case control study of infants with genetic predisposition for celiac disease observed that the risk of developing the disease increased two fold in children who were infected with rotavirus once and almost four fold for those who were infected with it multiple times [15].

### **Rota virus in Iraq**

The study of Salwa Ahmed, samples of feces from 976 children by gastroenteritis were gathered and examined aimed at type A rotavirus (RVA), amid January 2008 to December 2008 within three towns. In 40% of the cases (394), RVA antigen was noticed and 98 cases were obtainable for additional genotype examines by means of multiplex RT-PCR to isolate specific strain . G/P(genotype) grouping was verified for sixty nine cases, and nineteen and two as well as 8 cases stayed P-un kind able, G- un kind able and G/P-un kind able (UT), separately. The greatest predominant was G2 (40%, 39/98) which frequently related by P[16]. Rotavirus Group A stood noticed in 40% of 976 Iraqi children in conjunction with gastroenteritis. The major predominant genotype lived G2 that accompanying with P[6] and then G1. P[8] and P[UT]. Five G8P[6], and 7 G12 strains, coupled with P[6] or P[8], these discovered in the first period in Iraq. NSP2-3 and NSP5 genes of G8P[6] strains grouped plus DS-1-like human strains. The E2 NSP4 gene collected in cases' with animal strains of Rota virus, signifying change occasion. The elevated occurrence of Rota strains beside the G12 ,G8 in addition to P[6] genotypes in grouping with a DS-1-like genotype pattern in Iraq, required checked closely related strain of RVA which made challenge for the efficiency of vaccines for the current RVA.<sup>[16,]</sup>

### The past studies of viral infection in Iraqi cites:-

**In Mosul** Rotavirus was detected in 28.7% (43/47) of children with acute diarrhea. The peak incidence of RV diarrhea was seen in children aged 25-36 months (40%), furthermore, the present study shows the impact of different demographic variables on the positivity of rotavirus among children.. The study shows that the distribution of diarrhea causes among children with diarrhea according to different etiological agents due to rotavirus is (31.3%), pathogenic bacteria (28.7%), protozoa (36.7%) and combined pathogen (3.3%). The pattern of etiological agents varies widely in different countries [8, 10]. The higher rate of rotavirus infection 40% was found in age group 25 – 36 months, while the lower rate 25 % was found in age group 37 – 60 months. acute RV diarrhea occurred with similar frequency in males 31.8 % (27/85), and in females 30.8 % (20/65). The incidence of acute RV diarrhea in relation to residence is shown in (Table 4). A different proportion 39.2 (31/79) of patients living in the Urban area but 22.5 (16/71) living in the Rural area. Signs and symptoms associated with diarrheal illness that RV and non- RV were compared , dehydration (95.7%, 45/47 while non RV 90.3%, 93/103), vomiting (80.9%, 38/47 while non RV 67%, 69/103), fever ( 74.5%, 35/47 while non RV 80.6%, 83/103), abdominal pain (68.1%, 32/47 while non RV 79.6%, 82/103). The hospitalization rate was (93.6, 44/47) while the out patients was (6.4% 3/47). The difference was also found among the non RV children group ( 86.4% , 89/103 ) and outpatients was (13.6% ,14/103)..[17,18]

**In DIALA** The results showed that the overall infection rate by rotavirus among patients was 20.3%, and the highest infection rate was among those below 5 years of age. Rotavirus infection among adult patients was also recorded. Females had an insignificantly higher infection rate compared to males (22.1% vs. 18.9%). Patients consuming river's water had significantly higher infection rate compared to those used municipal or tank water (34.5%, 14.1% and 18.5%) respectively. Patients (below 2 years) feed artificially had higher infection rate com College of Vet. Med. Diyala University pared to those on breast or mixed feeding (28.2%, 19.1% and 18.8%) respectively. Although ,the rotavirus infections were recorded around the year, the highest infection rate was during spring and winter seasons (22.5% vs 21.4%). It was also found that neither bacterial nor parasitic co-infections were significantly associated with rotavirus infection .The significantly higher infection rate among patients consuming rivers water for drinking compared to other sources of water supply is consistent with almost all previous studies affirming the importance of contaminated water for transming the virus Of note, several studies have documented the detecon of rotavirus from rivers and surface waters by molecular techniques .Contaminaon of water undoubtedly comes through human and probably animal excreta, and in this regard it has been documented that one gram of the faeces of infected person contains more than 10 trillion of viral parcles, and that only 10-100 viral parcles are needed to transmit the infecon The present study as well as others [19] are in agr eement that infants (< 2 years) feed artificially are more liable for infection by rotavirus. It has been reported that human breast milk contains several factors that may play a role in preventing infection and of these is a glycoprotein ,



lactoherine, which is able to bind to and prevent rotavirus replication, beside the natural immune defense mechanisms.[19]

### Bagdad

In a survey of rotavirus induced diarrhea in 150 child less than 5 years referred to Ibn-Al-Atheer pediatric Hospital in Mosul city from 5th July 2007 to 5th August 2007. The stool specimens were investigated by Latex agglutination test (slidex – Rota kit, France) for the presence of RV antigen. The incidence of RV infection among children hospitalized with acute diarrhea was studied . Rotavirus was detected in 28.7% (43/47) of children with acute diarrhea. The peak incidence of RV diarrhea was seen in children aged 25-36 months (40%), furthermore, the present study shows the impact of different demographic variables on the positivity of rotavirus among children [1]. Acute Gastroenteritis remains a common illness among infants and children throughout the world, and mostly caused by viral organism (Rotavirus). This study consisted of stool samples collected in a clean and sterile disposable plastic container, from children under 2 years of age suffering from bloody and non-bloody diarrhea from Children Welfare Teaching Hospital in Baghdad, during the period from beginning of February to the end of May 2008. By Rapid qualitative test for the direct detection of Rotavirus group antigen in feces by agglutination of latex particles on slide, The study evaluates the relationship between etiological agent of diarrhea (Rotavirus) and gender, age group, type of feeding, and presence of blood in stool of the patients. The result revealed that the Rotavirus infection represents 24 case (37.5 %). With higher frequency in males more than females especially more than 6 months with artificial feeding, majority of cases whether severe or mild occurred in infants under one year of age especially [ > 6 ] months of life 11 case (45.8 %) higher than rates in other group. The age of infant is one of the factors in targeting preventive strategies; the weaning foods of infant are introduced to the diet very early as a result the infants are exposed to the environmental enteric pathogens. In addition to the increased frequency, the early age of weaning may also contribute to the increased severity of diarrheal illnesses that occur in smaller infants who are particularly susceptible to changes in fluid, electrolytes and nutritional balances, this is the most probably attributed to the poor defensive mechanisms of infants to fight against infection and to the rapid development of severe dehydration among them, this may reflect the fact that the increased resistance in older children and adult may be associated with the development of immunity or the loss of receptors for some specific adhesion . Diarrhea was strongly affected by mode of feeding in the Table 4. This study conformed to the common and established finding that diarrhea episode are more frequent in artificial feeding or called [formula fed] than in the natural feeding or called [breast fed. Mature human milk play a protective role in breast-fed children exposed to some parasites; both contain considerable amounts of immunoglobulin, mainly the secretory immunoglobulin A (s IgA) that may play a role in such protection. It has been shown that such immunoglobulin have antibody specificities, which reflects antigenic stimuli in the intestinal tract Human milk cells (macrophages, lymphocytes, neutrophils) and antibodies could protect intestinal mucosa remain



active in the neonatal intestine and possibly migrate to other tissue .The type of feeding was independent of mother's age, child's gender, and history of neonatal hospitalization but was associated with mother's level of education and family income, also another one major cause was related to mother's concern that their milk was not sufficient. In Conclusions the infection of acute gastroenteritis caused by Rotavirus show higher in males more than females especially > 6 months with artificial feeding and non-bloody diarrhea.[20,21]

**Babil** To determine the prevalence and demographic characteristics of rotavirus infection in Babylon city, Iraq. 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. the Results show : 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. The 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.[22]

**In Kerbla** generally, rotavirus positive gastroenteritis was more frequent 267(69%) than rotavirus negative gastroenteritis 119(31%) of the total examined stool samples, There was a relative increase in prevalence of rotavirus gastroenteritis in children above six months 142(53%) more than those below six months of age 125(47%) with the clear variance in rotavirus gastroenteritis patients among the gender which referred to an elevation in males 167(63%) more than females 100(37%) in both tested groups, moreover, according to the source of infection there was no difference in children between hospitalized 133(50%) and out-patients 134(50%) in both groups, as well as no clear variance among rotavirus positive patients regarding geographical distribution; urban were 137(51%), and rural were 130(49%) in both groups district to Karbala; in comparison with the type of feeding; the study showed an obvious increase(about two-fold greater risk)in rotavirus gastroenteritis 172(64%) in the children who were not exclusively breast- or bottle fed more than those who were exclusively breast-fed 95(36%) in both diarrheic groups. rotavirus is the main leading cause of severe gastroenteritis among children under five years of age in Karbala particularly in males above six months of age regardless the source of infection and geographic distribution; Rotavirus gastroenteritis can be considered as one of the nosocomial infections in Karbala Pediatric Teaching Hospital; promotion of breast-feeding would augment the impact of providing the effective protection against severe childhood rotavirus diarrhea.[23]



**Nagaf** Rota virus was detected in 80 cases (66.7%) of the total cases investigated by latex agglutination test, while PCR positivity was recorded in 85 cases (70.8%). Rota virus infection was also detected in healthy children who were involved as control group; 1/50(2%) detected by Latex agglutination assay versus 3/50 (6%) detected by NSP5 gene PCR assay. From the total of ten isolates that selected to propagate via cell culture using rhabdomyosarcoma (RD) cells, confirmation of the detection was accomplished by 8 isolates (80 %). Conclusions : We concluded that polymerase chain reaction is sensitive and specific technique for the detection of NSP5 coding gene and RD cell line is successful for the propagation of rotavirus. Of the 348 fecal specimens analyzed, 163 tested positive for rotavirus by latex agglutination test. Table (1) is illustrating the distribution of the diagnosed infants to have rotaviral gastroenteritis were little difference is found and male babies constitute 43.9% of the cases while female 163 tested positive for rotavirus by latex agglutination test. The study illustrated the distribution of the diagnosed infants to have rotaviral gastroenteritis were little difference is found and male babies constitute 43.9% of the cases while female infants were 40.5%. This slight difference may be attributed to the fact that in rural area male infants are privileged to a certain degree over females and receive more care from the parents. Otherwise, there is no facts improved that males are more susceptible for rotavirus infection than females . Distribution of LAT positive cases according to the governorates The following table (table 2) is illustrating the distribution of positive diarrheal cases for rotavirus according to LAT test in the mid Euphrates territories in the three governorates from which specimens collected. The distribution of LAT positive cases among governorates was 40%, 51.6% and 44% for Addiwaniya, Najaf and Babylon respectively In this study, rotavirus was detected in the stool of 42.45% (163/384) of patients studied. The highest percentage of the cases occurred in children at 9 and 10 months old ,which is the susceptible expected target age group. [24,25]

**AlQadisai** Of the 348 fecal specimens analyzed, 163 tested positive for rotavirus by latex agglutination test. Table (1) is illustrating the distribution of the diagnosed infants to have rotaviral gastroenteritis were little difference is found and male babies constitute 43.9% of the cases while female 163 tested positive for rotavirus by latex agglutination test. Table (1) is illustrating the distribution of the diagnosed infants to have rotaviral gastroenteritis were little difference is found and male babies constitute 43.9% of the cases while female infants were 40.5%. This slight difference may be attributed to the fact that in rural area male infants are privileged to a certain degree over females and receive more care from the parents. Otherwise, there is no facts improved that males are more susceptible for rotavirus infection than females . Distribution of LAT positive cases according to the governorates The following table (table 2) is illustrating the distribution of positive diarrheal cases for rotavirus according to LAT test in the mid Euphrates territories in the three governorates from which specimens collected. The distribution of LAT positive cases among governorates was 40%, 51.6% and 44% for Al diwaniya, Najaf and Babylon respectively In this study, rotavirus was detected in the stool of 42.45% (163/384) of patients studied. The highest percentage of the cases occurred in children at 9 and 10 months old (Table 3), which is the susceptible expected target age group.[26]

**Thi-Qar Province** The objective of this study is to determine the frequency of the one most important enteric viruses (rotavirus group A) in stool specimens of children aged less than five years, The age ,sex related distribution, seasonal pattern and clinical symptoms. A total of 100 fecal specimens (including 63 males and 37 females) are collected from infants and children under five years of age in Thi-Qar Province south of Iraq during Five Months (From November 2017 To March 2018). According to diarrhea suffered children which revealed that 45% are caused by Rotavirus, the frequency of male children patients with diarrhea caused by rotavirus was higher than their female. The samples are categorized into eight groups according to the age of the children: 1-5 months, 6-10 months, 11-15 months, 16-20 months, 21-25 months, 26-30 months, 31-35 months and 36-40 months. Age specific frequency in children patients with diarrhea, caused by rotavirus is high in aged 11-15 months. According to results the percentage of infection with rotavirus show that 16 (35.6%) children are fed on Breast feeding, 22 (48.9%) children are fed on bottle feeding and 7 (15.6%) children are fed on mixed feeding The prevalence of rotavirus in the present study among males 31 (68.9%) are higher than those in females 14 (31.1%) within children under 5 years old with significant differences between them.[26]

**Basra** A hospital-based study includes 120 children aged less than 5 yrs who were admitted to the pediatric wards with acute gastroenteritis over a period of five months from the October 1<sup>st</sup>, 2015 till March 15<sup>th</sup>, 2016. All patients underwent physical examination for sign of dehydration and assessment of severity of diarrheal episode by Vesikari score which considered various parameters including frequency, duration of diarrhea, vomiting, temperature, hydration status and the treatment received by the patients. A score of <7 was considered mild, 7-11 was moderate and  $\geq 11$  severe. Stool samples were collected within 48 hrs of hospitalization and examination for rotavirus was done by Enzyme Linked Immunosorbant Assay; One Step rotavirus Test (ABON biopharm, China) which is a qualitative immunoassay kit used for the detection of rotavirus in human stool sample ,The Result showed that : The frequency of rotavirus infection was 32.5%, about two thirds of admitted children presented with severe diarrheal episodes and one third with moderate diarrhea. Sixty two percent of the studied patients aged 3-12 months with higher frequency of males than females (62.5%, 37.5%) respectively. All studied children with rotavirus infection were below 24 months of age, with higher frequency in males than females (74.36%, 25.64%) respectively with P value 0.001. Reviewing the immunization status history of rotavaccine reveals that; 64 (53.3%) of patients have missed or did not receive any vaccine with approximate percentage (53.8%) in patients who were positive for rotavirus with significant result (P value 0.001) and only 36.7% of children had an immunization status that was appropriate for their age. One third of studied parents were illiterate with higher frequency in mothers than fathers (22.5%, 14.1%) with rotavirus infection in children belong to illiterate parents (25.6%, 7.6%) respectively, with statistically significant results. Bottle feeding with or without complementary diet had been reported in higher frequency of studied patients (59.2%) with positive rotavirus stool test in 71.8% with statistically significant result. Inpatient management of studied children reveals that zinc therapy, oral rehydration solution and antibiotics

prescribed for (56.4%, 66.7% and 89.7%) of patients with rotavirus infection respectively. [27,28]

In conclusion:- The immune correlates of protection against rotavirus reinfection and recovery from infection are poorly understood, although rotavirus-specific immunoglobulin A has a role in both aspects. The management of rotavirus infection focuses on the prevention and treatment of dehydration, although the use of antiviral and anti-emetic drugs can be indicated in some cases.

### Conflict of Interests.

There are non-conflicts of interest .

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## الخلاصة

يعد فيروس الروتا من افراد عائلة ريو فيردي التي تمتلك الحامض النووي الرايبوزي مزدوج الشريط RNA من اكثر مسببات الاسهال عند الاطفال والرضع الذين تتراوح اعمارهم من الاشهر الأولى لغاية عمر الخمس سنوات. حين بينت الدراسات حول العالم ان كل طفل يولد قد يصاب في سنواته الاولى بهذا الفيروس ومع كل اصابه يتطور المرض وتقل شدة الإصابة مع تكرار حدوثها ,ان الجينات المشفرة للفيروس تنتج تسع انواع مرضيه ومن اكثرها شيوعا هو *Rotavirus A* الذي يسبب 90% من مجموع الاصابات لدى البشر. تحدث الاصابة عند تناول الطعام والشراب الملوث او عند ملامسه السطوح الملوثه و الفم , للفيروس القدرة على مقاومه الظروف البيئية حيث يبقى حيا لعدة شهور في البراز الملوث وبدرجه حراره الغرفه , ينتشر الفيروس في دول العالم الناميه. ومنها العراق حيث ركزت الدراسه على وبائيه المرض ونسب الاصابه لفيروس الروتا من خلال استعراض الدراسات السابقه لهذا الفيروس في المدن الرئيسيه في العراق كبغداد وبابل والموصل القادسيه وذي قار والبصره: , وان المعلومات المتوفره من هذه الدراسه قد تساعد في معرفه اذا كان برنامج التطعيم الخاص بالفايروس فعالا في العراق.

**الكلمات الدالة:-** الفيروس العجلي , الاطفال , الاليزا , وبائية , التهاب الامعاء المزمن.