

Rotavirus gastroenteritis prevalence among children under five years of age in Karbala City

By Adel Ateyah Abd Ali AL-Nasrawi
Karbala University /College of Medicine
Department of Medical Microbiology
Adel-aa69@yahoo.com.

Abstract:

Background: Rotavirus is the major agent causing endemic and epidemic diarrhea in young children in both developed and developing countries (1), little is known about prevalence of rotavirus infections in Karbala.

Study design and objectives: This cross sectional study was performed to determine the prevalence, clinical significance, and possible risk factors for rotavirus gastroenteritis in Pediatric Teaching Hospital in Karbala governorate during the period from June through October 2009.

Patients and methods: 386 children less than five years of age with acute gastroenteritis attended Karbala Pediatric Teaching Hospital were studied both hospitalized and out-patients. Rotavirus in stool samples was identified by using two survey tests (One Step Rapid Chromatographic Immune Assay, and Slide Latex Agglutination test). Rotavirus positive patients were divided into two main groups according to the age; the first group was six months and below; and the second group was more than six months of age.

Results: 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.

Conclusions, 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.

Key words: Rotavirus gastroenteritis, Prevalence, Children under five years, Risk factors.

الخلاصة:

الخلفية العلمية: يعتبر فايروس الروتا من اكبر العوامل المسببة للإسهال المحلي و الوبائي في الأطفال في كل من البلدان النامية والمتطورة . ولا يعرف الكثير عن وبائية الإصابة بفايروس الروتا في الأطفال في مدينة كربلاء. **تصميم الدراسة والأهداف:** صممت الدراسة الحالية لتحديد نسبة الإصابة والأهمية السريرية وعوامل الخطورة المرافقة للإصابة بالإسهال المعدي المعوي الناتج عن فايروس الروتا في الأطفال وأنجزت الدراسة في مستشفى الأطفال التعليمي في محافظة كربلاء خلال الفترة الممتدة من حزيران إلى تشرين الأول لسنة 2009. **المصابين وطرائق العمل:** تم دراسة 386 طفل دون سن الخامسة من العمر لكل من الراقدين والمراجعين لمستشفى الأطفال

التعليمي في كربلاء وتم تشخيص فايروس الروتا في نماذج البراز للأطفال المصابين بالإسهال باستخدام اختبارين مسحين هما (الختبار المناعي الكروماتوغرافيا السريع المنفرد و اختبار تلازن حبيبات اللاتكس على الشريحة) , وتم تقسيم الأطفال المصابين بالإسهال الناتج عن فايروس الروتا إلى مجموعتين رئيسيتين حسب العمر: المجموعة الأولى ضمت الأطفال بعمر ستة اشهر فما دون والمجموعة الثانية شملت الأطفال الأكبر من ستة اشهر ولحد الخمس سنوات من العمر.

النتائج : أظهرت نتائج الفحص لنماذج البراز للأطفال المصابين بالإسهال إن عدد نماذج البراز الموجبة لفايروس الروتا كان 267(69%) اكبر مما أظهرته نماذج البراز السالبة للفايروس والبالغة 111(31%) لجميع نماذج البراز المفحوصة , ولوحظ الارتفاع النسبي في التهاب المعدة والأمعاء الناتج عن فايروس الروتا 142(53%) في الأطفال بعمر اكبر من ستة اشهر أعلى مما عليه في الأطفال بعمر اصغر من ستة اشهر 125(47%) , مع تباين واضح في نسبة الإصابة بالتهاب المعدة والأمعاء الناتج عن فايروس الروتا على مستوى الجنس, والتي بينت ارتفاعا ملحوظا في الذكور 163(63%) اكبر مما لوحظ في الإناث 100(37%) في أطفال المجموعتين. ووفقا لمصدر الإصابة فلم يلاحظ أي تباين في عدد الأطفال المصابين بالتهاب المعدة والأمعاء الناتج عن فايروس الروتا سواء الأطفال الراقدين في المستشفى 133(50%) والمراجعين من خارجها 134(50%) في أطفال المجموعتين, وعلى مستوى التوزيع الجغرافي للأطفال للمصابين بالفايروس في مدينة كربلاء : لم يلاحظ اختلافا واضحا في عدد الأطفال المصابين بالفايروس في المجموعتين, إذ لوحظ إن عدد الأطفال المصابين من مركز المدينة 137(51%) وعدد الأطفال المصابين من أطراف المدينة 130(49%), مقارنة بنوع التغذية للأطفال المصابين بالفايروس- حيث لوحظ ارتفاعا واضحا في نسبة الإصابة وبحوالي الضعفين 172(64%) في الأطفال غير المعتمدين على الرضاعة الطبيعية اكبر مما هي عليه في الأطفال المعتمدين على الرضاعة الطبيعية بصورة مطلقة والتي كانت 95(36%) في أطفال المجموعتين.

الاستنتاجات : يعتبر فايروس الروتا السبب الرئيسي لالتهاب المعدة والأمعاء الشديد في الأطفال بعمر دون سن الخمس سنوات في محافظة كربلاء , سيما في الأطفال الذكور بعمر اكبر من ستة اشهر بغض النظر عن مصدر الإصابة بالفايروس (سواء في الأطفال الراقدين داخل المستشفى أو المراجعين من خارجها) وكذلك التوزيع الجغرافي للمصابين في المدينة, ويعتبر فايروس الروتا كأحد المسببات المرضية التي تنتقل عن طريق المستشفى في كربلاء , وان تحفيز الرضاعة الطبيعية للأطفال يمكن أن يزيد من فرص توفير الحماية الكفوءة ضد الإسهال الطفولي الشديد الناتج عن فايروس الروتا .

Introduction

Rotaviruses cause an estimated 140 million cases of gastroenteritis and 800,000 deaths in Children between the ages of 6 months to 2 years in developing countries (1). Children in the poorest developing countries account for 85% of rotavirus deaths, Every child in the world will have at least one rotavirus infection before age five (2,3). Rotavirus infection appears to peak during the winter season, except in countries with tropical or subtropical climates, where the virus is present year around (5).

The virus mainly spreads via the feco-oral route, through respiratory route, person-to-person contact, or through contaminated environmental surfaces and fomites (5, 6). An infected person may excrete up to 10 billion viruses per gram of feces, providing a source for water contamination via sewage or fomites (inanimate objects) and food contamination via tainted hands (7). After an incubation period of (1 - 2) days, the onset of gastroenteritis is sudden; symptoms can last from (4 - 5) days range from severe watery diarrhea and vomiting, to fever, nausea, and occasional abdominal pain; loss of fluids and electrolytes can lead to severe dehydration, hospitalization, and even death (8).

Rotavirus replicates in certain villus enterocytes that line the inside of the small intestine; this replication decreases the ability of intestine to absorb salts and water (3, 4). Many studies have described seven rotavirus groups (A to G) only group A, B, and C infect humans. Group A, which has multiple strains, causes the majority of childhood infections. A number of different rotavirus strains may present in communities at the same time because of the ability of rotavirus to change their surface proteins over time like Influenza infections (9).

Because of the disease burden associated with rotavirus and the fact that improvements in hygiene and sanitation have not decreased the incidence of rotavirus gastroenteritis; Vaccination is the only way to prevent severe episodes of rotavirus infection, and rotavirus vaccines will be an important new addition to a portfolio of interventions to prevent and manage diarrheal disease; This portfolio should include rotavirus vaccines, as well as oral rehydration solution ORS, breast-feeding, and improvements in nutrition, hygiene, and water quality(21); Efforts to develop vaccines against rotavirus have been under way since the 1980s. In 1998, the first rotavirus vaccine was

licensed in the USA, and the routine use of this vaccine for the immunization of healthy infants was recommended. A potential rotavirus vaccine, when available, is considered as effective protection against rotavirus infection; however, before a decision is made on the introduction of the vaccination for rotavirus in each country, specific national epidemiological studies and knowledge of current disease burden are required (9).

A nation surveillance system for rotavirus infections has not been implemented to date in Iraq, and little is known about the epidemiology of rotavirus infections in Karbala; Owing to these data, this cross sectional study was performed to assess the prevalence and clinical impact of rotavirus gastroenteritis in children less than five years of age. This study also aimed to determine possible risk factors like age, sex, geographical distribution and type of feeding; that might predispose the children to rotavirus diarrhea.

Materials and Methods

This study was conducted in the period from June to October 2009 in Karbala Pediatric Teaching Hospital which serves urban and suburban districts in Karbala City.

Patients selection: 386 children under five years of age; hospitalized and out- patients who suffered from recurrent watery diarrhea for a period between (4 – 8) days, vomiting, fever, abdominal pain, and various degrees of dehydration were evaluated.

Stool Samples collection: fresh stool samples were collected from diarrheic children in clean plastic containers immediately and processed according to the diagnostic kits instructions directly.

Samples processing: rotavirus in the stool samples was demonstrated using two rapid survey detection techniques; a Rapid One Step Chromatographic Immune Assay for the qualitative detection of rotavirus in stool samples (ACON Laboratories, USA-kit) which shows relative sensitivity more than (99.9%) , relative specificity (97.8 %) and relative accuracy (99.0%); and Slide Latex Agglutination test (plasma tec Laboratory products Ltd UK -kit) which shows (97.0%) specificity and sensitivity depending upon the kits index, instructions; and according to multiple previous survey studies have been used these tests for the same purpose (10). Both diagnostic kits were stored at 4⁰C during the study period.

The patient's parents were interviewed and completed a questionnaire including information on socio-demographic characteristics such as age, gender, source of infection (hospitalized or out-patients), residence, type of feeding (breast or bottle feeding) as well as the current signs , clinical symptoms and treatments; all data were recorded on a follow up chart during acute gastroenteritis. The severity of acute gastroenteritis was estimated based on recurrent watery diarrhea, vomiting, fever, abdominal pain, variable degrees of dehydration, and need for medical visits.

The diarrheic children were divided into two subgroups: first group those who were (exclusively breast-fed) in the first six months of their life and the second group those (not exclusively breast-fed or bottle-fed) in order to investigate the effects of rotavirus gastroenteritis on newly born children below six months of age, and to know the effect of breast feeding on rotavirus gastroenteritis syndrome.

Results

During the study period, 386 children with acute gastroenteritis were recruited. Rotavirus was identified in 267 (69%) of the children stool samples and 119(31%) of the children stool samples were negative for rotavirus infection (fig. No .1).

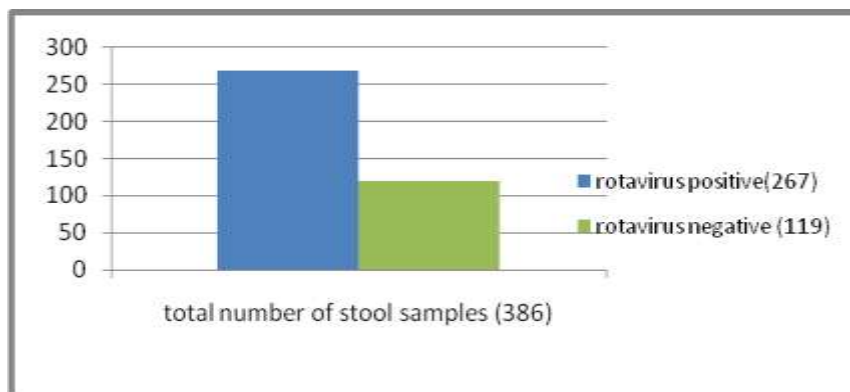
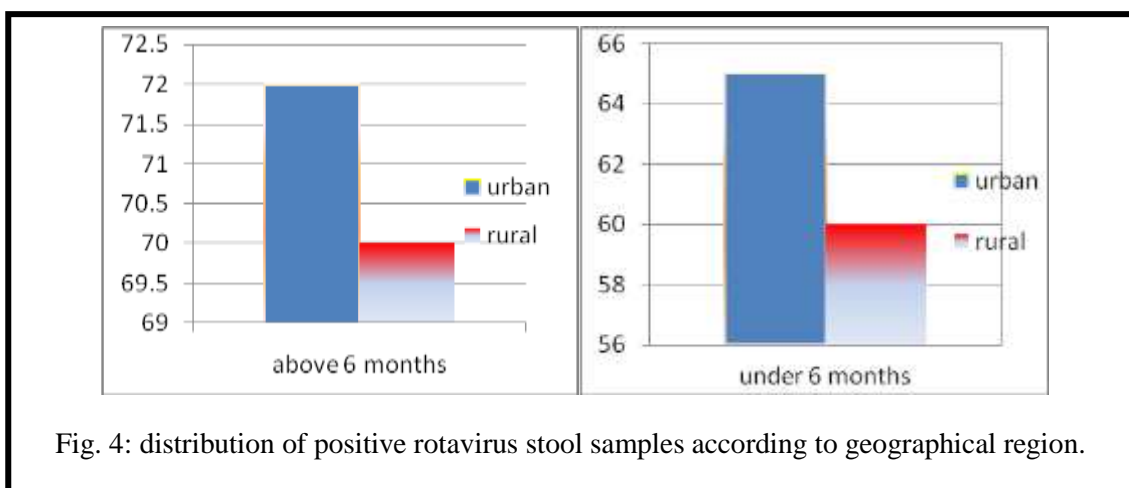
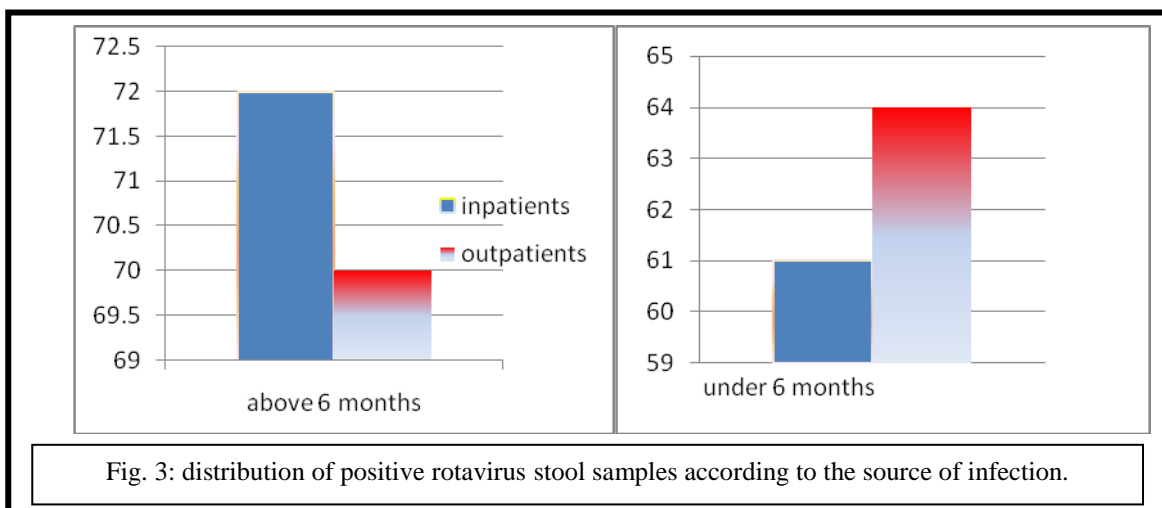
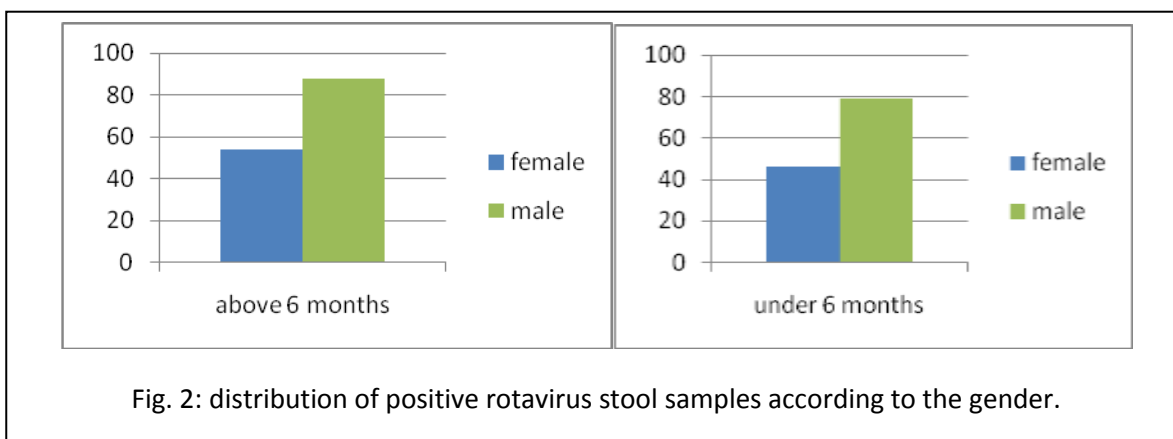


Fig. 1: Distribution of total rotavirus positive and negative cases at Karbala Pediatric teaching hospital during June to October 2009.

Rotavirus gastroenteritis positive cases were classified according to the following risk factors or parameters: age, sex, source of infection, geographical distribution, and type of feeding as it revealed in table no.1; among a total of 267(69%) rotavirus-positive 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%) table 1. Concerning the gender, there was an increase in prevalence of rotavirus gastroenteritis 167(63%) in males more than females 100 (37%) in both groups of children (under and above six months of age) table 1; with relative increase in males 88(62%) and females 54(38%) in the second group (above six months) more than males 79(63%) and females 46(37%) in the first group (under 6 months) of age fig.2 . Regarding the source of infection, in general, there were no differences in rotavirus gastroenteritis prevalence between the two children groups; hospitalized children 133(~50%), and out- patients 134(~50%) fig.3. Concerning geographical distribution of infected children there was an approximate rate of rotavirus positive patients between urban 137(51%) and rural 130(49%) fig.4; and among the type of feeding there was an obvious increase in the prevalence of rotavirus gastroenteritis in the patients who were none exclusively breast fed (bottle fed children) 172(64%) in both groups more than those exclusively breast fed 95 (36%) of rotavirus gastroenteritis positive children below and above six months of age fig.5.

Table 1: Distribution of Rotavirus positive cases according to Risk Factors at Karbala pediatric teaching hospital during June to October 2009.

Parameters		6 Months and Below No. (%)	6 Months to 5 years No. (%)	Total No.	% Of Grand total
Gender	Females	46 (37 %)	54 (38 %)	100	(37 %)
	Males	79 (63%)	88 (62%)	167	(63%)
Source of +ve samples	In patients	61(49%)	72(51%)	133	(50%)
	Out patients	64(51%)	70(49%)	134	(50%)
Geographic Distribution	Urban	65(52%)	72(51%)	137	(51%)
	Rural	60(48%)	70(49%)	130	(49%)
Type of Feeding	Breast- fed	43(34%)	52(37%)	95	(36%)
	Bottle- fed	82(66%)	90(63%)	172	(64%)
Total no. of +ve Stool Samples		125(47%)	142(53%)	267	(100%)



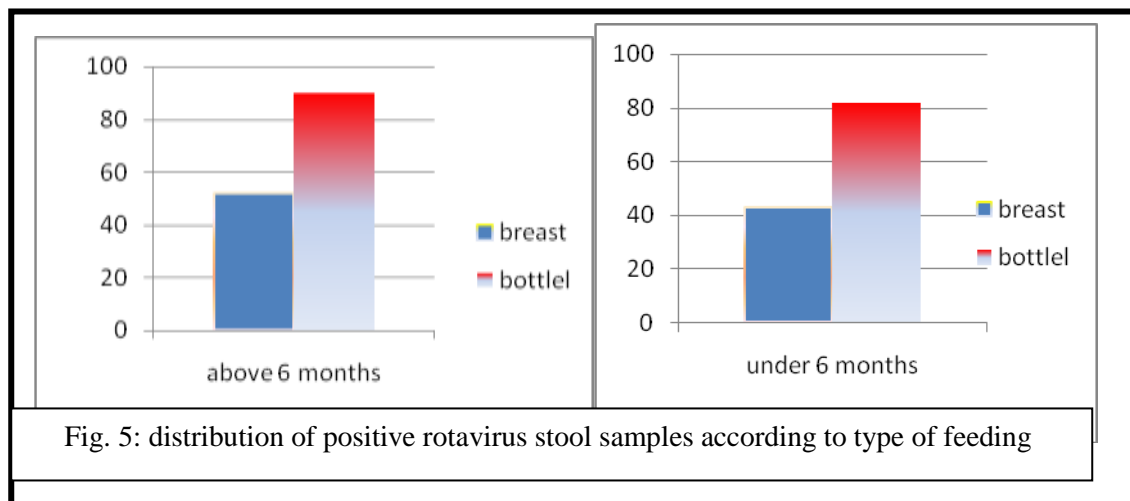


Fig. 5: distribution of positive rotavirus stool samples according to type of feeding

Discussion

Rotavirus is the major agent causing endemic and epidemic diarrhea in young children in both developed and developing countries (1); Our

cross sectional study was carried out in summer, the most diarrheic season in Iraq, at the period from June to October 2009 in Karbala Pediatric Teaching Hospital which represent the central recipient for regional pediatric emergency cases; and because Iraq is one of the subtropical climate countries where the virus may present year around(5, 22). This concept is similar to other studies about rotavirus prevalence from Punjab - India which revealed that rotavirus infection has been observed throughout the year with maximum occurrence in November and another peak in the hot and dry months (12), and other study about rotavirus illness in United States that showed seasonal fluctuations (15), while no seasonal variation has been found in other epidemiological studies in Saudi Arabia and India (11, 13).

In our study we used a Rapid One Step Chromatographic Immune Assay and Slide Latex Agglutination tests for the qualitative detection of rotavirus in stool samples because there have been many efforts to develop rapid and economical methods for detecting rotavirus antigen in stool ; these antigen-detection systems have become the test of choice in the clinical setting (14, 15).

Rotavirus was identified in 267 (69%) of the children stool samples, our findings are in agreement with reports worldwide and it is approximate to rotavirus gastroenteritis prevalence in Nicaraguan children in similar study was 67% (16), and it is less prevalent than another identical epidemiologic studies in Izmir-Turkey on 2003 which was 80.7% (15), and more than 29.5% in Ahvaz Iran on 2005 (17).

Our study showed relative increase in rotavirus positive children above six months 142(53%) more than those below six months of age 125(47%), this result has an agreement with other epidemiological studies in Pune, India about the relationship of age to susceptibility to rotavirus gastroenteritis that showed the percentage of rotavirus positive children from 6-24 months of age were 86.09 % but the most susceptible age was 6-12 months as in other developing countries (18).

According to the gender association of rotavirus gastroenteritis we noticed that an increase 167(63%) in males more than 100 (37%) in females in both groups of children below and above six months of age; this result has an agreement with various previous studies in India that showed males were more frequently affected with rotavirus gastroenteritis than females (19). Or this result may be obtained by a chance in our current study.

Regarding the source of infection we found there were no differences between the two rotavirus positive groups of children; hospitalized 133(~50%), and out- patients 134(~50%), this result approximates another epidemiological study in various parts of India have been conducted on the prevalence of acute childhood rotavirus diarrhea in which rotavirus was detected in 20-71% of the hospitalized children less than five years of age (20).

Concerning the geographic distribution of rotavirus positive patients; an approximate proportion appeared at urban diarrheic children 137(51%) and rural children 130(49%), these results are in agreement with other epidemiological studies that performed on rotavirus infections which show rotavirus illness affects all children worldwide within the first few years of life regardless of their level of hygiene, quality of water, food or sanitation (8).

Regarding the type of feeding, there was a clear difference between the two patients groups in resisting rotavirus infection and its complications; by resistance of absolute breast fed children 95(36%) more than none absolute breast(bottle-fed) children 172(64%) , this resistance may be due to maternal antibodies which protect younger infants (below six months of age) that may show asymptomatic infection; while, older children (more than six months of age) may have built up immunity from repeated earlier infections. This fact may agree with another epidemiological study that revealed; although nursing babies may still become infected, asymptomatic infection is more likely in the first three months of life due to the passive immunity of transplacental antibodies and human breast milk (7).

Finally, the highly considerable advantages can be achieved from this study is that rotavirus has been considered as an important etiological agent of summer gastroenteritis in children under five years of age, and it is one of the nosocomial infections in Karbala; as well as latterly, obligatory introduction of rotavirus detection in stool samples testing for diarrheic children attending Karbala Pediatric Teaching Hospital or other neighbor Hospitals is a good temporary solution; Thus, this test is now considered as one of the principal and routine requirement for the physician in order to determine the causative agents nature of diarrheic children under five years particularly less than six months of age; and to assume an appropriate medical prescriptions, treatments and advanced planning for resisting and controlling such important clinical infection.

Conclusions

- 1- Rotavirus gastroenteritis consists 69% of total diarrheic children in Karbala during the period from June to October particularly in males with relative elevation in the prevalence in males and females above six months of age.
- 2- Rotavirus gastroenteritis can be considered as one of the nosocomial infections in Karbala; No different rotavirus gastroenteritis prevalence between hospitalized and out-patients, with an approximate rate in episodes between urban and rural diarrheic children during the same period.
- 3- An obvious elevation in rotavirus gastroenteritis prevalence in none exclusively breast or bottle fed in both groups of children more than those exclusively breast fed.

Recommendations

- 1- It's recommended to perform further epidemiological studies in other areas of Iraq with larger sample size and more advanced detection tests to know the prevalent rotavirus genotype, and introduction of an appropriate protective vaccination.
- 2- Frequent hand washing, water purification and chemical disinfection of environmental objects and fomites are necessary for controlling rotavirus and a variety of human pathogens; and to prevent virus transmission by waterborne routes, as well as, oral rehydration solutions ORS, breast-feeding, and improvements in nutrition, hygiene, and drinking water quality are required.

Acknowledgements

We thank the head manager and laboratory collaborators of Karbala Pediatric Teaching Hospital in Karbala City for their grateful cooperation, technical assistance, and for helpful advices.

References

1. Shobha, B. D. G. and Purva, M.: Molecular epidemiology of rotavirus in India. August 2003. Ind. J. Med. Res. V118: pp 59-67.
2. Parashar,U.; Gibson,C.; Bresee,J.; Glass,R. :Rotavirus and severe childhood diarrhea. June 2006. Emer. Infect. Dis. 12(2): 304-306.
3. Parashar, U.D.; Hummelmann E.G.; Bresee, J.S.; Miller, M.A.; Glass, R.I.: Global illness and deaths caused by rotavirus disease in children. Emer. Infect. Dis. Vol.9: No.5, May 2003.
4. Uchida, R.; Pandey, B.D.; Sherchand, J.B.; Ahmed, K.; Yokoo, M.; Nakagomi, T., *et al.* Molecular epidemiology of rotavirus diarrhea among children and adults in Nepal: detection of G12 strains with P [6] or P [8] and a G11P [25] strain. 2006 .J. Clin. Microbiol. 44:3499–3505.
5. Gallimore, C.I. ; Pipkin, C. ; Shrimpton, H. ; Green, A.D. ; Pickford, Y. ; McCartney, C. ; Sutherland, G. ; Brown, D.W. ; Gray, J.J. : Detection of multiple enteric virus strains within a food borne outbreak of gastroenteritis: an indication of the source of contamination. 2005. Epidem. And Infect. 133: 41–47.
6. Vanzyl, W.B.; Page, N.A.; Grabow, W.O.; Steele, A.D.; Taylor, M.B.: Molecular epidemiology of group A rotaviruses in water sources and selected raw vegetables in southern Africa. 2006. Applied and Environm. Microbiol. 72:4554–4560.
7. Kelly, A. and Reynolds, S. PhD, Rotaviruses: A Major Cause of Childhood Morbidity and Mortality. Water Condition and Purification. [Midline; date of entry May 2000]. Page 1-3.
8. Glass,R. I. J.; Bresee, B. ; Jiang, J. ; Gentsch, T. ; Ando, R. ;Fankhauser, J. ; Noel, U. ; Parashar, B. ; Rosen, S. and Monreo, S. : Gastroenteritis viruses: an overview. 2001. Novartis Found .Symp. 238:5-25.
9. Zafer Kurugol, *et. al.*: Rotavirus gastroenteritis among children under five years of age in Izmir, Turkey. 2003. The Turk. J. of Ped. 45 (4):1-5.
10. Jenkins, C.T.: An evaluation of five commercially available kits for the diagnosis of rotavirus infection.1988. Serodiagnosis and Immunotherapy in Infectious Diseases. 2: 137-141.
11. Assouli Sulfan M. E., *et. al.*: Rotavirus Infection in Children in Saudi Arabia. 1992. Am. J. Trop. Med. Hyg. 46(3): 272-277.
12. Ram, S.; Khurana, S.; Kusana, S.B.; Sharma, S.; Vadehra, D.V.; Broor, S.: Bioecological factors and rotavirus diarrhoea. 1990. Ind. J. Med. Res. 91: 167-70.
13. Broor, S.; Husain, M.; Chatterjee, B.; Chakraborty, A.; Seth, P.: Temporal variation in the distribution of rotavirus electropherotypes in Delhi, India. 1993. J. Diarrhoeal Dis. Res. 11: 14-18.
14. Thomas, E.E.: Evaluation of Seven Immunoassays for Detection of Rotavirus in Pediatric Stool Samples. June 1988. J. Clin. Microbiol. 26 (6): 1189-1193.
15. Herrmann, J.; Blacklow, N.R.: Gastroenteritis viruses. 1995. In: Lennette EH, Lennette DA, Lennette ET, editors. Diagnostic procedures for viral, rickettsial and chlamydial infections. 7th ed. Washington DC: American Public Health Association.
16. Filemone B. R.: Pediatric Rotavirus and Norovirus diarrhea in Nicaragua. 2008. Academic dissertation for the degree of Doctor of Medical Science from Karoliniska Institutet.
17. Samarbafzadeh, A.R.; Mazaheri, T. E.; Makvandi, M.; Taremi, M.: Epidemiological aspects of rotavirus infection in Ahvaz,Iran. 2005. J. Health Popul. Nutr. 23(3):245-9.
18. Kelkar, S.D.; Purohit, S.G.; Simha, K.V.: Prevalence of rotavirus diarrhoea among hospitalized children in Pune, India. 1999. Ind. J. Med. Res. 109: 131.
19. Broor, S.and Singh, V.: Viral gastroenteritis. 1984; Ind. J.Gastroenterol. 3: 225-9.
20. Jain, V.; Parashar, U.D.; Glass, R.I.; Bhan, M.K.: Epidemiology of rotavirus in India. 2001. Ind. J. Ped. 68: 855- 62.
21. Ahmed, F.: Children at risk of developing dehydration from diarrhea: A case-control study. 2002. J. Trop. Ped. 48: 259–263.
22. Cook, S. M.; Glass, R. I.; Lebaron, C. W.; and Ho, M. S. 1990. Global Seasonality of rotavirus infections. Bull. W. H. O. 68:171–177.