#### **ORIGINAL ARTICLE**

# Diarrhea among under-five Years children in Mosul City: Epidemiological and Microbiological study

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## ABSTRACT

**Background:** for the purpose supporting and contributing to the reorientation of health decision-makers and developing potential aspirations of the city of Mosul, especially in view of the challenging circumstances. **Aim:** to measure the prevalence of diarrhea among children under five years old throughout epidemiolocal and

Aim: to measure the prevalence of diarrhea among children under five years old throughout epidemiolocal and microbiological perspective

**Methods:** A hospital based cross-sectional study was performed at the pediatric teaching hospitals in Mosul city-Republic of Iraq between the 7th of January and 30th of July, 2019. All under five years old children who lived in Mosul City during the study period and admitted to the Mosul pediatric because of diarrhea Hospitals were involved in the present study. Factors included demographic characteristics, behavioral and environmental variables, parent's knowledge and attitudes toward diarrhea were unified into the questionnaires. Statistical package for social Sciences (SPSS) version 25.0 was used for data analysis.

**Results:** No valuable and important correlation (p= 0.172) was identified amongst children of girls who had moderate odds of diarrhea than children of boys (OR= 0.88). Kids after 6-12 months had higher levels than older people. Yet the duration of the previous childbirth interval was not associated. Sons of adolescent mothers (14– 19) years old) were more likely to have had diarrhea compared with sons of mothers aged (20–24) years. Diarrhea arising during June to August demonstrates substantial correlation with other times.

**Conclusions:** Our analysis found the identified prevalence of diarrhea among children under five years of age in Mosul city is high.

Keywords: Diarrhea, under-five, Mosul, Epidemiological, Microbiological

### INTRODUCTION

Globally, diarrheal diseases remain a major public health threat with nearly 1.7 billion cases occurring annually<sup>1,2</sup>. Diarrhea is the second gravest killer of less than five children worldwide<sup>3,4</sup>. The World Health Organization (WHO) discovered that worldwide, approximately 1.7 billion cases and 760,000 deaths of childhood diarrhea occur each year<sup>5,6</sup>. While the prevalence of diarrhea among children in this age group in developed countries, including Iraq, has decreased in the last 20 years, the disease burden has remained consistent with age4,7,8,9. Childhood diarrheal disease is still a leading cause of mortality and morbidity despite significant improvement that occurred in the decline of mortality rate among children under-five years<sup>2,10</sup>. Preventable and treatable diseases with easy and cheap management still effected the Children in developing countries and elevate the chance of disease more ten times than children in age under five years in developed countries<sup>4,11</sup>. Multiple factors contribute to the occurrence of diarrhea among children under 5 years of age<sup>10,12</sup>. Types and length of time of feeding, socioeconomic status, quality of water storage devices, poor hand-washing habits of the mother, deficiency of hand-washing facilities and insufficient waste disposal policies were the most important risk factors documented in many studies<sup>13</sup>. Public care providers, leaders and health care staff require sufficient knowledge and documentation at the stage in which interventions are planned and applied, which is necessary in order to raise visibility and measure the issue at a disaggregated age and to illustrate spatial inequity<sup>14,15</sup>. For the purposes of assessment of disease patterns, trends and relationships between health events and determinants, many spatial data analyses have been applied in epidemiology<sup>16,17</sup>. Hotspots in epidemiological studies differs widely, and may include features, like incidence or prevalence, transmission efficiency or risk, or probability of disease emergence<sup>13,18,19</sup>.

Diarrhea status in Iraq: Several years ago, some preliminary work was carried out to determine etiological and epidemiological status of diarrhea in Iraq. A etiological screening of enteropathogens as carried out on 800 children suffering from diarrhea who were attending Kirkuk Hospitals province between 2007- 2009. The ages of children between 1 months-12 years. Stool samples were collected from each individual and were examined for parasitic infestation and cultured on different media for identification of bacteria. The study found that children age, maternal age (less than thirty years), education of mothers, and family's size. The highest rate appeared in summer followed by spring, autumn and winter respectively. Were the variables significantly associated with an increased risk of diarrhea. E. histolytica/E. dispar associated with bacteria were reported the highest rate among the age group 7-12 months 39.53%, 30.17% respectively, while the distribution of E. histolytica is highest among 2-6 months 32.64%. Furthermore, the predominant age group distribution of O157: H7 E. coli diarrheal cases are among 19-24 months<sup>20</sup>. A stool sample was obtained in order to examine Sapovirus in children under five years of age. The study revealed that SaVs were considered to be accurate at 0.18 (9 per cent). Amplicons were sequenced and only seven samples were genotyped, 5(5/7) belonged to the GI.1 genotype, 1(1/7) belonged to the GI.4 genotype, and 1(1/7) belonged to the GII.8. The GI.1 was the dominant strain in Baghdad and the most contaminated the children were 4 05 years of age. In the present research SaVs was first identified in Baghdad<sup>21</sup>. To determine enteropathogenic that causes Diarrhea among children between (1-15) years old, in the city of Baghdad 2014. The study examined 103 sample of stool, the result represents that highest ratio of infected by 48.545%, Rotavirus 39.80%, mix infected(parasite + Rotavirus)

8.73%, with record of lowest infection ration 2.91%, found during the study that the age group 1-5 years showed the highest percentage of injury Rotavirus by also reached 60.98% case common injury (Rotavirus and parasitic) where this age group, the highest recorded percentage of injuring 66.67%, As for parasitic infected which represented within the same category %26. The results showed that age group (more than 5 years) and deity 56% when compared with the other groups and recorded the results .There is a high significant difference between males and females in the pathogenesis of parasitic and viral infection when the probability p <0.01, male recode 62-60% more than female 40-38% on serias<sup>22</sup>. Enteric viruses among children < 5 years of age diagnosed with diarrhea were investigated at the Mosul Governorate. From December 2012 and March 2013, one hundred fecal samples were obtained. Both samples were screened for rotavirus utilizing latex agglutination examination, and norovirus utilizing NVGI and NVGII (RT-qPCR). Enteric viruses have been identified in 42 out of 100 children (42%) who had severe diarrhea. At least one viral agent was contained in the 42 samples positive for enteric viruses. NVGII was the most prevalent virus in 24 cases (57.14%), led by rotavirus in 14 cases (33.33%), and NVGI in 4 cases (9.52%)<sup>22</sup>. To study the sources of protozoa and their occurrence rate in diarrhoeal children aged from 0-60 months. Six hundred samples of stools were obtained from the Al-Sowera General Hospital (the Wasit Governorate-Iraq), and tested for pathogenic protozoa. The incidence of pathogenic protozoa was 208 individuals, comprising 34.6% of all collections with diarrheal stools. The number of Endameba histolytica infectious cases was 96, reflecting the largest proportion (16%) of overall diarrheal stool specimens, accompanied by Giardia lamblia, 66 cases (11%) and 14 cases (2.3%) Cryptosporidium parvum<sup>23</sup>.. To differentiate Salmonella organisms from kids, "170 fecal samples were obtained from children aged 5-years of both sexes who had diarrhea in Al-Hospital's teaching laboratories in the governorate of Thi-. Nineteen isolates were classified as Salmonella and provided for by the National Salmonella Center in Baghdad, five Salmonella serotypes were defined as (Salmonella typhimurium 8(42.1%), S.braenderup 6(31.58%), S.hadar 3(15.78%), S.eneritidis 1(5.27%), and S. Munchen. 1(5.27%)". Statistics revealed that the average prevalence of rotavirus infection in patients was 20.3%, which for those below 5 years of age was the greatest risk of infection. Infection with rotavirus was also reported in adult patients. The infection incidence for females was insignificantly higher than for males (22.1% vs. 18.9%). Patients using river water have a slightly higher risk of contamination relative to patients utilizing public or tank water (34.5%, 14.1% and 18.5%). Patients (under 2 years) disproportionately have a greater mortality risk than people on breast or combination feeding (28.2%, 19.1% and 18.8% respectively). While rotavirus infections were reported throughout the year, the highest infection incidence occurred in the spring and winter seasons (22.5% vs. 21.4%)<sup>24</sup>. A general study of the patients ' cause for diarrhea visited Al-Rashidia Village Health Center outside Mosul Town. 754 Case specimens aged from 1-69 years. The findings show Salmonella sp. And the potential sources of diarrhea are types of parasites such as Entamoeba coli, Entamoeba histolytica and Giardia lamblia. To sp. Salmonella The number of illnesses recorded is 44.04%, while the lowest percentage of people under 20 and 29 years of age is 17.3%<sup>8</sup>. At Al-Shatrah hospital in Thi-Qar province's Shatrah area, 720 stool samples were obtained and the standard existing methods for intestinal parasite identification

were tested. The prevalence of gross intestinal parasites was 43.1% and 29.2% of Entamoeba histolytica parasites, 12.9% of Giardia lamblia parasites, 0.7% of Hymenolepis nana and 0.3% of Enterobius vermicularis parasites were the lowest amounts involved<sup>25</sup>.

With the aim of helping and contributing to reorienting health decision-makers and building future visions of the city of Mosul, especially after the difficult circumstances that it went through during the last five years and which have devastated the health care system and the absence of accurate medical documentation and its lack of the most basic health and environmental requirements, This study comes in an attempt to describe the prevalence of diarrhea among children under five years of age and to determine the most important risk factors of the disease.

## METHODS

**Ethical considerations:** Data collection followed protocols approved by Ethical medical Research committee at the Directory of health, Mosul City. Iraq. Parents of children under five years of age was joined in the study and they invited to a sign informed consent on behalf of their children.

**Study design:** A hospital based cross-sectional study was performed at the pediatric teaching hospitals in Mosul city-Republic of Iraq between the 7th of January and 30th of July, 2019. In this scenario participants who meet the inclusion criterion and consented to our analysis were specifically picked when they arrived at the hospital.

**Study population:** All under five years old children who lived in Mosul City during the study period and admitted to the Mosul pediatric because of diarrhea Hospitals were involved in the present study.

**Data collection tools and techniques:** Observational checklist and face-to-face interview with the use of pretested intervieweradministered structured questionnaire were used in collection of data. Factors included demographic characteristics, behavioral and environmental variables, parent's knowledge and attitudes toward diarrhea were unified into the questionnaires.

**Data management and analysis procedure:** SPSS version 25.0 was used for data analysis. Number and Frequencies were calculated as descriptive analysis. Chi-square was computed to determine the association between the independent and dependent variables of the study. p-value $\leq 0.05$  were used to signify the differences between the variables.

## RESULT

No valuable and important correlation (p= 0.172) was identified amongst children of girls who had moderate odds of diarrhea than children of boys (OR= 0.88). Kids after 6-12 months had higher levels than older people. Yet the duration of the previous childbirth interval was not associated. Sons of adolescent mothers (14–19 years old) were more likely to have had diarrhea compared with sons of mothers aged 20–24 years. Diarrhea arising during June to August demonstrates substantial correlation with other times. Of the children interviewed in April, those interviewed in March had double the risk of experiencing diarrhea (OR= 3.01, p < 0.001). This study finds real evidence that the most frequently known viral agents were rotavirus (29.7%), immediately followed by norovirus (11.8%), astrovirus (3.2%), sapovirus (1.8%) and adenovirus (4.8%). Shigella was the main commonly identified bacteria among bacterial agents (7.2%), led by Non-typhoidal Salmonella spp (6.3%) and Enterotoxigenic E. Coli (five per cent). The causative agents with regard to age groups was investigated. *Shigella, Non-typhoidal Salmonella spp, and Enterotoxigenic E. coli* as abacterial agent were most common age among older children, while, among the infant the viral agents were the highest rate (p < 0.01). From the results, it is clear that a significant association were found between bacterial agents and hot weather during summer season (June August) in City of Mosul in contrast, *norovirus* peaked in autumn and winter

| Variables                | Sample ( $n = 975$ ) |      |
|--------------------------|----------------------|------|
|                          | No                   | %    |
| Age group (months)       |                      |      |
| 1-12                     | 69                   | 7.1  |
| 13-24                    | 239                  | 24.5 |
| 25-36                    | 316                  | 32.4 |
| 37-48                    | 257                  | 26.4 |
| 49-60                    | 94                   | 9.6  |
| Gender                   | No                   | %    |
| Girls                    | 682                  | 69.9 |
| Boys                     | 293                  | 30.1 |
|                          | Mean                 | SD   |
| Mother age (years)       | 27.3                 | 6.1  |
| Mother Education (years) |                      |      |
| Low                      | 491                  | 50.4 |
| Middle                   | 273                  | 28   |
| High                     | 211                  | 21.6 |
| Socioeconomic status     | No                   | %    |
| High                     | 145                  | 14.9 |
| Middle                   | 362                  | 37.1 |
| Low                      | 468                  | 48   |
| Diarrhea types           | No                   | %    |
| Bloody Diarrhea          | 296                  | 30.4 |
| Nonblood Diarrhea        | 679                  | 69.6 |

#### DISCUSSION

Our results demonstrated that, the prevalence rate of diarrhea among children under-five years old was 22.8 %. The existing findings is agreements with earlier study in Iraq  $(21.35)^{26}$  and many previous studies in different countries such as Ghana, 19.2%<sup>1</sup>, Benshangul gumz, 22.1%<sup>7</sup>, west Gojjam zone, 18%<sup>2,13</sup>, Egypt, 19.5%<sup>12</sup>, Eastern Ethiopia, 22.5%, India 25.2%<sup>27</sup>, Burundi, 32.6%<sup>28</sup>, Arba-Minch rural community, 31%<sup>29</sup>. However, the current study is higher than other studies that applied in two Iranian provinces (Ilam and Mazandaran), the diarrhea was prevalent among 14.8% and 13% children respectively<sup>30</sup>. These vibrations may be due to the period of the study, size of sample, and geographical differences. Several epidemiological studies of diarrheal diseases were carried out among children in countries close to Iraq, a large part of which belongs to the Eastern Mediterranean and African countries. The predominance of disease occurred in a dry and hot climate<sup>6</sup>. It was observed that intestinal diseases in moderate latitudes have a seasonal pattern, with the highest rate of diseases during the summer months<sup>3</sup>. This reflects reported confirmation of a strong association between gastrointestinal contamination with intestinal pathogens and an rise in air temperature<sup>30</sup>. One of the main objectives of the study is to determine spatiotemporal patterns of diarrhea in Mosul City. The study also showed the existence of substantial variation in the spatial distribution of diarrhea within the study area. Furthermore, the results demonstrate that clear

seasonal patterns in diarrheal occurrence with two peaks every year, January-February and the major peak occurring in July, at the same time that rainfall and temperature and demonstrate seasonal peaks. Superior tests with E.coli have been identified as the most important etiological causes of childhood diarrhea. Overall, 77(24%), headed by Shigella flexneri (0.6%), Vibrio cholerae (0.6%), and Salmonella paratyphi B (0.3%), were the most common isolates of pathogenic isolates, according to previous studies .DEC prevalence in this sample was approximately 24 per cent higher than the other studies from developed countries<sup>31-35</sup> indicating variability in DEC distribution depending on geographic position. Some research showed that Enterotoxigenic E.coli (51.9%), Enteropathogenic E.coli (42.8%) and Enteroagrregative E.coli (5.1%) were likely to be within DECs. While EPEC has been established as the most prevalent DEC pathotype in several developing countries, our findings have shown ETEC to be the most prevalent isolated DEC followed by EPEC and EAEC, suggesting the need for ongoing monitoring to better understand the pattern in distribution. The diarrhea induced by ETEC is of a secretory type: the disease starts with a sudden onset of watery stools (without blood or inflammatory cells) and frequently vomiting which contributes to dehydration due to lack of fluids and electrolytes.

#### CONCLUSIONS

Our analysis found the identified prevalence of diarrhea among children under five years of age in Mosul city is high. The study indicates that real prevention steps are required to reduce the high prevalence of diarrhea. Health awareness programmers will be adopted and checked to reduce the occurrence and responsibility of diarrhea including rising importance of solid waste and wastewater management. The results further provide the healthcare stakeholder with valuable evidence to address childhood diarrhea avoidance.

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Competing interests: The authors declare no competing interest

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