



## Epidemiology of diarrhoea in the Holy City of Karbala in 2015

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### ABSTRACT:

The aim of study was providing researchers, doctors, governing bodies such as Kerbala Health Directorate, Ministry of Health and National IHR Focal Point with a comprehensive statistical analysis of the prevalence of diarrhoea at Al Hussein Teaching Hospital in the holly city of Karbala in 2015. The study identify the etiology of diarrhoea in adults across four age groups ranging from 15 and over, examining the variation to gender and age and month /season of the year.

The study involves a total of 2583 cases of diarrhoea report as a chief complain to the hospital from January to December 2015.

The statistical data analysis reveals that diarrhoea is still a major complain for all age groups as the hospital received approximately 7 cases on daily bases all over the year 2015. Female Patients were the most disadvantaged over male in a ratio of 5:3. Young adults between 20-44 years of age were the worst affected and represent %46 from the overall patient number. The study consolidates that more incidences have happened in the season of warm summer in June due to , yet even higher in cold January and December as more than two third of infection was viral. *Entameba histolytic* was the predominant parasitic cause to diarrhoea with 23% of the cases and *Giardia lamblia*. Main bacterial cause represented in *Vibrio Cholera* of 2.9% and very few cases of *E. Coli*.

**Keywords:** Epidemiology, Etiology. Acute diarrhoea, persistent diarrhoea, *Entameba histolytic*, *Giardia lamblia*, *Vibrio Cholera*, National IHR Focal Point

### INTRODUCTION

Diarrhea is a common illness for all age groups. In the United States only more than 375 million diarrheal episodes occur yearly with 11% resulted in emergency department visits <sup>[1]</sup>. Remarkably 200,000 people were admitted to the hospitals in the USA in 2003 for symptom management <sup>[2]</sup>. Despite worldwide success in the fall of all cause and diarrhea-specific mortality in the past 30 years, diarrhea remains the second leading cause of death In developing countries <sup>[3][4]</sup>. Diarrhoeal diseases responsible for 1.5 million deaths each year among children aged 1-4 years <sup>[5]</sup>.

Diarrhea generally is defined as the increase in the frequency and change in consistency of stools <sup>[6]</sup>. Microbial etiology of diarrhea is bacterial such as *Vibrio Cholerae*, *Salmonella Spp.*, *Shigella Spp.*, *Escherichia coli*, *campylobacter jejuni*, *Yersinia enterocolitica*, *staphylococcus*, *vibrioparahemolyticus*, *clostridium diffcile* or viral mainly as *rotavirus*, *adenovirus*, *colicivirus*, *astrovirus*. Parasites are another cause including *Entameba Coli*, *Entameba Histolytica*, *Giardia*, *Lamblia*, *Cryptosporidium* and *Isospora*. Other causes are including metabolic disease, hyperthyroidism, diabetes mellitus, pancreatic insufficiency, food allergy, lactose intolerance, antibiotic associated diarrhoea, irritable bowel syndrome<sup>[7]</sup>.

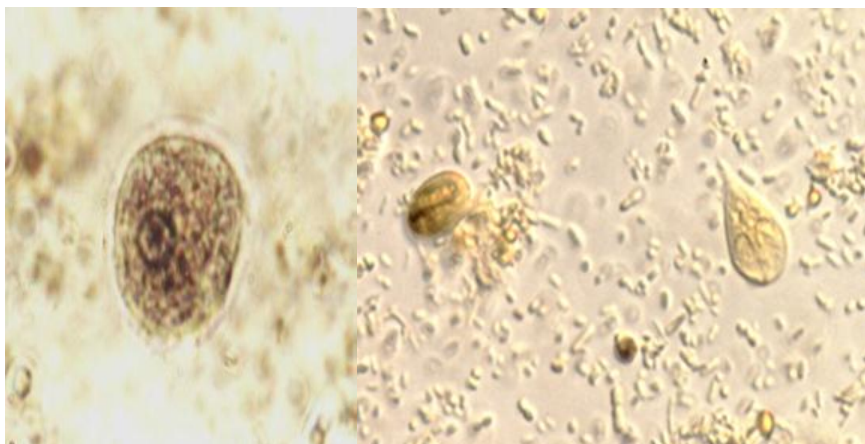


Figure 1: Photomicrograph reveals the ultrastructure of *Entamoeba histolytica* cyst on the left and *Giardia* trophozoites with cysts on the right<sup>[8]</sup>.

The epidemiology, microbial etiologies, risk factors and pathogenesis of this common serious problem remain poorly understood<sup>[9]</sup>. Like acute diarrhea, persistent diarrhea may be associated with several different potential etiologies<sup>[10]</sup>. Anyone can catch infectious diarrhea which spread quickly among babies and young children who are not toilet-trained or who may not wash their hand well after going to the bathroom it can also easily spread to the adults taking care of them and helping them with diapering and toileting<sup>[6]</sup>.

Therefore, we conducted this comprehensive study of the epidemiology and potential viral, bacterial and parasitic causes of persistent diarrhea among adult presented in the biggest medical establishment in Kerbala, Al-Husseiny hospital, for the period of January to December 2015.

## Method

Patients were split into four groups according to their age as 15-19, 20-44, 45 -64 and over 65 in age. Every group was subdivided into male and female patients. Stool specimens were collected from 2583 patients who attended Al Hussein hospital in Kerbala as outpatients and inpatients from January to December 2015 with Diarrhea as a chief complain.

A clean dry container was used for the collection of faecal samples and was brought to the Microbiology laboratory as soon as it is passed. This is to avoid any deterioration and alterations in morphology to the protozoa if present. The specimen container was clearly labeled with the patient's name, date, and time of passage of the specimen.

The macroscopic appearance of the stool was observed initially as this can give a clue to the type of organisms present. A drop of normal saline (0.85%) on clean slide was placed, as it is isotonic, with a small piece of stool on the slide and mixed with saline then covered with a cover slip. If the specimen contained mucus, the examination was done without saline. Iodine was also used to examine the nuclei of cysts and 1% of Eosin to provide a pink background and help to clear the unstained objects examine under 10X and 40X objectives. Report of finding was produced and sent back to the physician.

Upon the request of the physician and for those need the results of a culture for appropriate treatment, a bacterial culture is performed. This is due to the fact that cultures are not required for effective management of the majority of cases of diarrhea and dysentery, patients will require only rehydration and not antimicrobials. Therefore, 167 specimens were cultured exclusively for *Salmonella*, *Shigella* and *E. coli*. MacConkey agar with crystal violet and Xylose-lysine-deoxycholate (XLD) agar were used as a medium of moderate or high selectivity for the isolation of *Shigella* and *Salmonella*.



Using an applicator swab, a small amount of feces was collected from areas with visible blood or mucous, if present. The swab was rolled over the first quadrant of the MacConkey, XLD and HEA plate. Then a sterile 1uL inoculating loop was used to streak for isolation.

**Table 1:** Colony morphology of common enteric bacteria on differential and selective plating media<sup>[11]</sup>

Organism	MacConkey agar with crystal violet	XLD *	HEA **
<i>Escherichia coli</i>	Pink to rose	Large, flat, yellow, opaque	Large, salmon-pink to orange, encircled by zone of precipitate
<i>Shigella spp.</i>	Colourless	Red	Green, moist and raised
<i>Salmonella spp</i>	Colourless	Red, with or without black centre	Blue-green, with or without black centre

\*XLD: Xylose-Lysine-Deoxycholate; \*\*HEA: Hektoen enteric



Figure 2: *E. coli* bacteria cultured on three differentiated and selective media, From the left to the right: MacConkey, XLD and HEA plates. <sup>[12]</sup>

During the time of Cholera outbreak in some provinces near Kerbala, the hospital lab tested for the presence of the pathogen using Thiosulfate-citrate-bile salts-sucrose agar. Medium-sized convex, smooth, yellow colonies were identified as positive. However some strains of *V. cholerae* also appeared green or colourless on TCBS. This is due to delayed sucrose fermentation so that the results were still positive.

## RESULTS

The study was conducted at Al Hussein Medical Hospital in Kerbala. A total number of 2583 patients with diarrhoea as a main complaint were included. They attended the hospital outpatient department or/and the Accidents and Emergencies department and admitted consequently to the hospital to manage their symptoms from the period between January 2015 and December 2015. Patients were divided into 4 groups depending on their age as 15-19, 20-44, 45-64 and over 65 in age. Then every group was subdivided into male and female patients. The results were presented in the following manner:



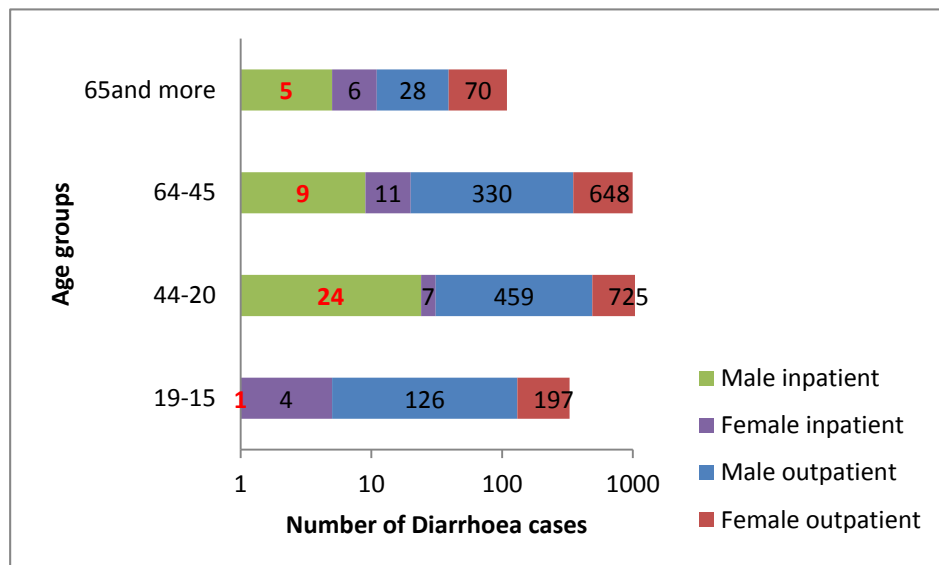
## I. Prevalence of Diarrhoea in comparison to other reported illness.

Table 2: represents the number of incidents of Diarrhoea comparing to other reported incidences in the hospital for the period of year 2015.

Age range/years	Other pathological cases		DIARRHOEA ASSOCIATED CASES	
	female	male	female	male
19-15	16029	15865	197	126
44-20	26359	29498	725	459
64-45	25409	26475	648	330
65 or more	14842	17670	70	28
Total per gender	82639	89508	1640	943
Total cases	172147		2583	
Percentage			63%	37%

A total of 2583 case of diarrhoea was reported out of 172147 cases from all other 358 types of pathological cases.

## II. Distribution of Diarrhea among Male and Female Patients.



**Figure3:** represents the number of diarrhoea cases among both Male and Female who attended the hospital as an outpatient and in-house patients.

Female outpatients have the higher number of diarrhoea incidences across all age groups of 725, 648, 197 and 70 in comparison to 459, 330, 126 and 28 in male respectively. However, for those admitted into the hospital, the total number of male patients has exceeded the number of female with 39 to 28 as shown in figure 4.



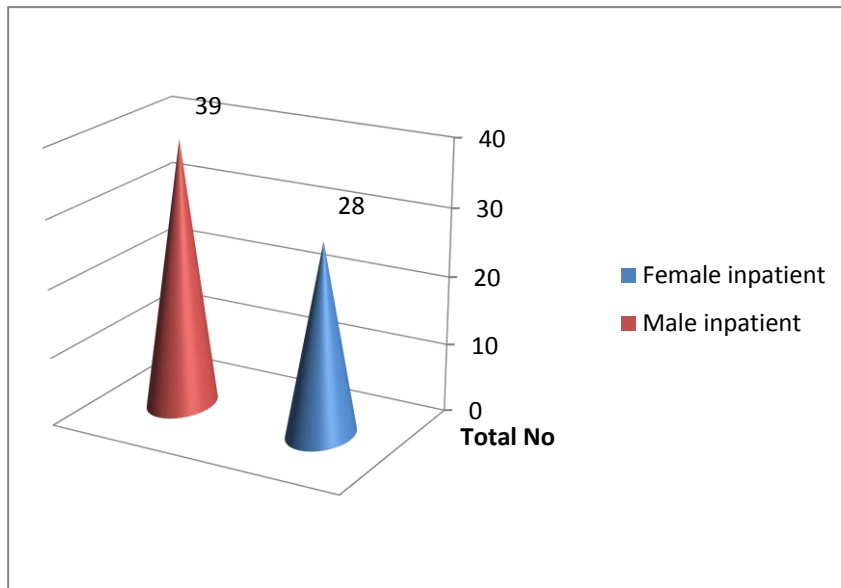
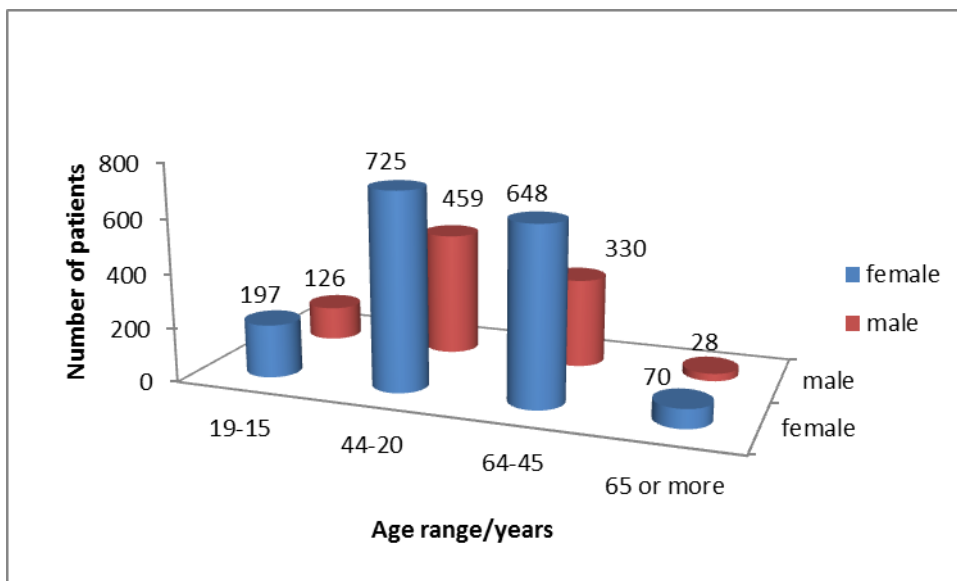


Figure 4: The total Number of reported diarrhoea incidents in Male and Female inpatients separately.

### III. Prominence of diarrhoea infection in different age groups.

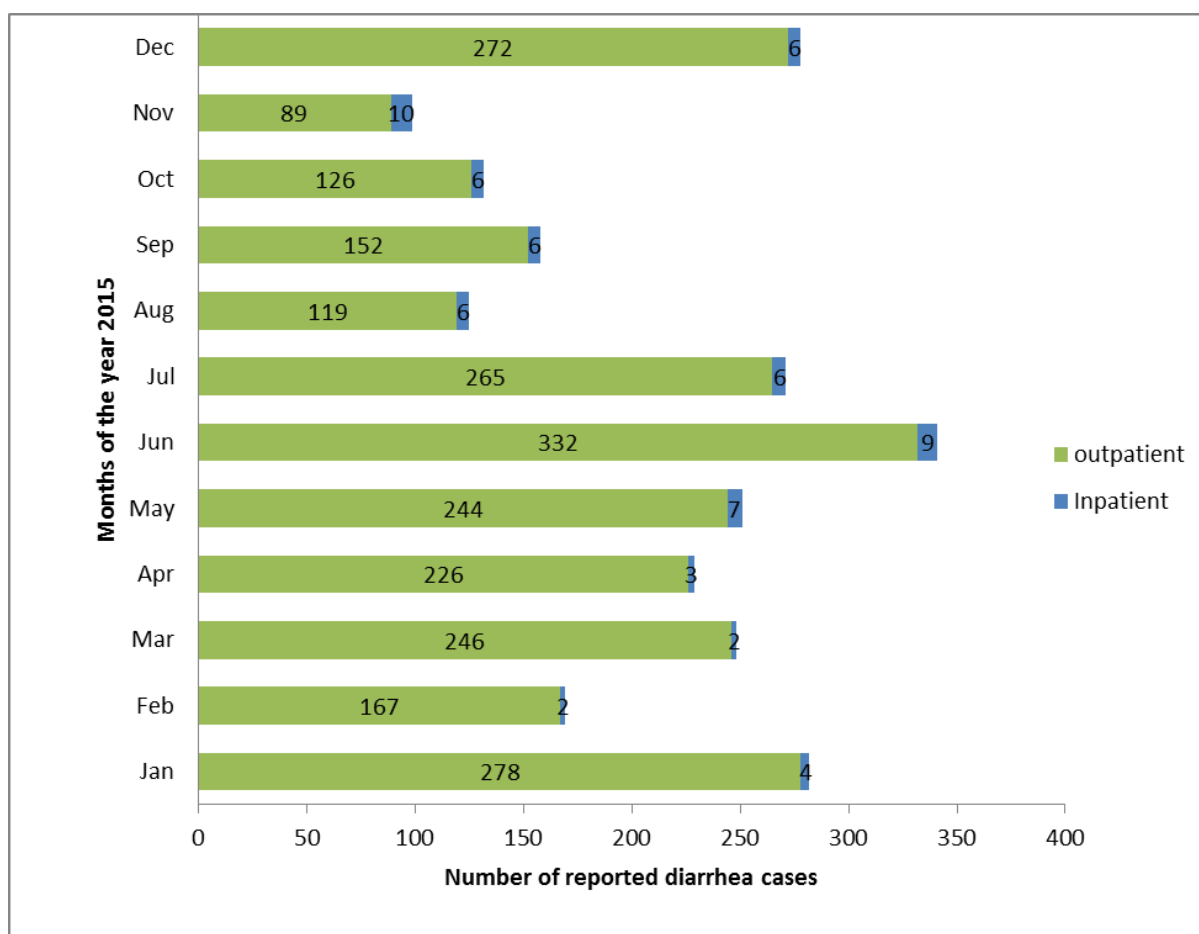


**Figure 5:** Diarrhoea infection in different age groups for male and female patients.

The figure indicates that the highest infection rate was reported among young adults of 20-44 years in age with 725 in female and 459 male patients. Middle aged patients between 45-64 years were second where female patients had almost double the number of male as 648 and 330 consecutively. Adolescents of age range 15-19 years were third and elderly group of over 65 years of age reported the least number of incidences of only 70 and 28.



#### IV. Association of diarrhea incidences with the month/s of the year



**Figure 6:** represents the number of diarrhoea cases in 2015 distributed over the 12 months of the year.

The table illustrates that the highest number of diarrhoea cases were reported on the hot month of June 2015 with total of 332 cases with 9 on the top on the patients were already in house from both genders. January falls second and third is December with 282 and 278 cases respectively. August had the fewest number of 125 cases.

#### V. Main causes and Microbial Etiology of diarrhoea incidences in Kerbala

**Table 3:** Main causes of Diarrhoea for the all reported cases in 2015.

Cause of Diarrhoea	Name of Pathogen	Inpatient cases	Outpatient cases	Total	Percentage %
Bacteria	<i>Escherichia coli</i>	3	0	80	3
	<i>Vibrio Cholerae</i>	0	77		
Parasite	<i>Entameba Histolytica</i>	12	565	686	26
	<i>Giardia Lamblia</i>	0	109		
Virus		45	1765	1810	70
Functional diarrhoea		2	0	2	less than 1
Malnutrition, tropical ,and sprue NOS		5	0	5	less than 1
Total Number of diarrhoea cases		67	2516	2583	100



Viral infection caused the majority of the cases represents 70%. Parasitic as *Entameba Histolytica* and *Giardia Lamblia* were second representing accumulatively 26%. Bacterial cause, specifically *Vibrio Cholerae* and *Escherichia Coli* was responsible for 3% of the cases. Other causes such as Functional diarrhoea and diarrhoea caused by conditions such as malnutrition, tropical and Sprue represents a very small percentage with less than 1%.

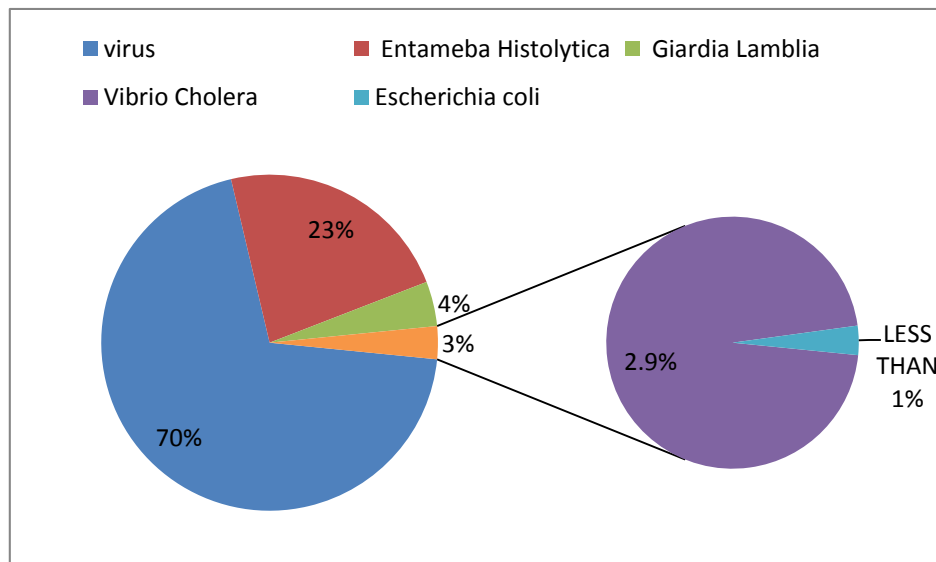


Figure 8: represents the microbial etiology of reported diarrhoea.

Viruses caused the most of microbial cases with 70%. *Entameba Histolytica* and *Giardia Lamblia* were the identified parasites and represent 23%. Bacteria caused the least number of microbial cases with just 3% most of which was *Vibrio Cholerae* approximately 2.9% and *E.coli* represents much less than 1%.

### Discussion and conclusion

Diarrhoea is one of the principal causes of morbidity and mortality among children in the developing world <sup>[9]</sup>. Although mortality from diarrheal disease is decreasing globally, morbidity is not <sup>[13]</sup>. The study comes up with a number of findings and conclusions regarding the epidemiology of this disease in our holey province, Kerbala.

Table 2 shows that diarrhea cases have represent 1.5% from the overall cases that were seen at Al Hussein Teaching Hospital in Kerbala. Although this percentage doesn't sound too high especially when comparing with similar one in the United State which estimates 3%-5% from the population has suffer from chronic diarrhea during any given period of time <sup>[11]</sup>. However, is still significant as the hospital received 15 case complains from diarrhoea to every a 1000 of other kind of pathological cases and in average 7 cases daily all over year 2015. The factors contributing to the high incidents of diarrhoea in developing countries include the overcrowded conditions, poor sanitation, contaminated water and inadequate food hygiene <sup>[14]</sup>.

Table 2 also indicates that overall 63% of diarrhoea reported patients were women while only 37% were men. Figure3 echoes that the occurrence of diarrhea is significantly higher in female outpatients rather than male which is due to several reasons, including that women are in more contact with children practically of their own putting them in more vulnerable position to contract the infection. Also women deal with the impact of the food more than men through the preparation of food make them more exposed to contaminants. This finding comes in a line with similar studies in other parts of the country such as the one carried out by Bushra and others in 2005 at Al-Rashidia village near Mosul of which females complains from diarrhea



were %29 to % 17 in male<sup>[15]</sup>. Other studies worldwide expressed that sex-associated biological characteristics can contribute to amplify gender differentials in health <sup>[16]</sup> but could not explain precisely why women is more prone to infection than men and they only suggest that it might be related to immunological or physiological or even genetically factors that could play part in making women more Susceptible to the infection proportion of injury to women than men with the knowledge that diarrhea disease It happens to both sexes and all age .

In contrary, figure 4 shows patients who suffered persistent diarrhea and subsequently admitted to the hospital as inpatients were higher in male than female with 39 to 28 cases. This is due to the fact that men spent more time outdoor and can have more contact with external environment which would have more contaminates comparing to indoor environment <sup>[17]</sup>. Another reason is cultural as a lot of patient women who suffers mild to moderate infection similarly to other self-limited illness may prefer to treat their illness at home and usually get better without medical intervention or with over the counter medication ,and they rarely seek a treatment from the hospital.

Figure 5 illustrates clearly that the higher risk groups of the infection has happened in the age group of 20-44 year of age among other age groups. This is due to the fact that young people is more frequently dine out as part of their life style. Most restaurants and fast food take away places struggle to maintain hygiene standards <sup>[18]</sup>. In addition, The exposure to pathogenic agents that cause the disease is one factor, other factors including the nature of work, exposure to pollutant agent, eating junk food, inhalation of dust and contaminated air since we know that some viruses that cause diarrhea transport to human through air especially viruses.

Figure 6 investigates the coloration of the occurrence of diarrhoea with time of the year. It shows that when the weather changes from spring to summer season and temperature starts soring in June, the highest number of diarrhoea cases was reported. This is no doubly related to the ability of bacteria to grow, replicate, and development during the hot season<sup>[19]</sup>. Human body respond to this bacteria in the hot month in addition the contaminated factor increase in this season <sup>[20]</sup>. Higher temperature during hot season leads to increase the average of infection due to people having cold drinking , ice-cream, fruit and vegetable that being contaminated or exposed to the housefly that transmit the egg of parasite<sup>[21]</sup>

The figure is quite controversial as it shows that the number of infection was still high despite of the cold weather in January and December and inorder to understand that and interpret the figure data correctly we need to look at it in conjugated with table 3.

Table 3 list causes of all reported diarrhoea as documented in the hospital database. Physicians establish the cause of infection based on the clinical symptoms, medical examination and supported most of the time by the results of microbiology laboratory tests. Viral infection was the most prominent cause and contributed to 70% of the total number of cases. The high percentage of viral infection causing diarrhea could explain our finding in Figure 6 that cold winter season in Iraq which starts at the end of November and lasts to the end of January had a considerable number as viruses widespread in this kind of weather causing the maximum damage. Research shows that Norovirus is the most common cause of epidemic diarrhea among adults and school-age children. Adenovirus infections are common in all age groups <sup>[22]</sup>. Parasites were second and attributed to 26% of the total cases in which *Entameba Histolytica* had the most proportion of 23% as showing in figure 8 while *Giardia Lamblia* caused the rest. This finding goes in line with other studies carried out in the country and abroad. Amebiasis is caused by infection with the protozoan *E. histolytica* after ingestion of cystic protozoa classically in fecal contaminated soil, food or water <sup>[23]</sup>. Giardiasis is a





leading diarrheal illness found worldwide. It is the most frequently diagnosed intestinal parasitic disease in the United States <sup>[23]</sup>. It is most commonly caused by the ingestion of *Giardia* cysts, as showing in figure 1, typically from contaminated water which then exit the cyst to multiply and colonise the upper small bowel<sup>[24]</sup>.

Bacterial cause, specifically *Vibrio Cholerae* and *Escherichia Coli* was responsible for 3% of the cases. As of 22 November 2015, WHO received notification from the National IHR Focal Point of confirming a total of 2,810 cases of *Vibrio cholera*, In Karbala alone, there was 157 <sup>[25]</sup> cases 77 of which is included in this study as they fall within the study specified age range. This was a major problem as Kerbala was getting ready to the pilgrimage of Arbâeen that takes place in Karbala on 2 December 2015. A total of 10 million pilgrims were expected to attend the ceremony. Therefore the early detection played a vital role in controlling the disease without causing a devastating damage to the public health. Preventive and control measures including promote awareness to travellers and the public about the disease, based on this results were very successful as there was no reported cases of cholera on December.

Other Minor causes such as functional diarrhoea, which considered as chronic or recurrent diarrhea not explained by structural or biochemical abnormalities<sup>[26]</sup>, symbolises very small number of just two cases. Malnutrition which usually leads to increased frequencies and durations of diarrheal illnesses, with a 37% increase in frequency and a 73% increase in duration <sup>[27]</sup> represents with rare conditions of tropical and Sprue a very few numbers of a total of five cases. In addition to all the above, chronic diarrhoea can't be the result of a disease processes only, medication, genetic abnormalities or a variety of other causes can contributed but it was not mentioned .

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