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Vibriosis in Human and Animals of Iraq

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ABSTRACT: A species from the genus Vibrio is the cause of the bacterial disease known as vibriosis. About 12 diseases from these species, which are found in a diverse range of aquatic and marine habitats among the more than hundred species of the gene Vibrio, infect people. Vibriosis infections cause by Cholera and non-cholera. cholera is a severe form of diarrhea that, if left untreated, can quickly be fatal. It is primarily spread through contaminated water and direct personal contact. non-cholera Vibrio spp. such as (Vibrio parahaemolyticus, Vibrio alginolyticus, and Vibrio vulnificus) are generally contacted through exposure to sea water or by consuming contaminated raw or undercooked seafood. Vibriosis incidence is favoured by climate change and rising temperature seas and rivers water are although their concentration undergoes a notable increase in the warm months due to favorable ecological conditions. Outbreak cholera and non-cholera in many countries of the world but of Iraq only Vibrio cholera in human except one case reported in Basra which is Vibrio parahaemolyticus. In the previous studies, it was show that other types of non-cholera Vibrio were isolated from Iraq shrimp in Basra governorate. The purpose of this study is to show cases infection of cholera and non-cholera in human and animals of Iraq.

Keywords: Vibriosis, Cholera, Non-cholera, Climate change, Iraq

1. INTRODUCTION

Bacterial disease known as vibriosis is caused on by species of the genus Vibrio has a diverse host range, including both wild and cultivated fish [1]. Vibrio spp are Straight or comma-shaped rod bacteria with polar flagella wrapped in a sheath, gram-negative and halophilic. Typically, they are non-spore-forming facultative pathogens that convert nitrate to nitrite, ferment D-fructose, maltose, and glycerol. bacteria are ubiquitous in estuarine, marin and freshwater environments. Vibrio spp. characterized by high salinity and temperatures varying from 10 to 30 ◦C [2,3,4].

Nomenclature
Vibrio : V
Classical : Cla
El Tor : ET

Presently there are approximately 147 Vibrio species and four subspecies are recognized, 24 of which are harmful to both plants and animals. Ten of the twelve Vibrio species that have frequently isolated from humans and 10 are confirmed human pathogens. The majority of the pathogenic species are animal pathogens, and the three most common and severe ones for humans are V. cholerae, V. parahaemolyticus, and V. vulnificus, closely followed by Vibrio alginolyticus. Generally, the human pathogenic vibrios induce external otitis and conjunctivitis in addition to diarrhea or extra-intestinal infections, which are typically wound infections. Many species infect other animals with diseases, including vertebrates most frequently in fish and invertebrates such as (blue crabs and shrimp) [5]. Vibriosis in fish is typically characterized by poor growth, lethargy, and tissue necrosis, as well as skin discoloration in infected fish. Additionally, erythema at the base of fins, vent, and mouth, as well as red lesions in the muscle, are indications of infection [6].

Historically, either cholera or a non-cholera infection was identified as the cause of vibriosis in humans. The treatment and provision of safe drinkable water has virtually eradicated cholera, an acute diarrheal disease primarily

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brought on by intake of water or food carrying toxigenic V. cholerae (serogroups O1 and O139), in affluent nations. Consuming contaminated shellfish, most frequently oysters, or coming into contact with polluted water directly through recreational or ccupational activities are the usual causes of non-cholera Vibrio infections. Non-cholera Self-limiting gastroenteritis to severe, life-threatening necrotizing fasciitis, wound infections, and septicemia are characteristic Vibrio infections [7,8].

Vibriosis in humans historically has been recognized as either cholera or non-cholera infection. Cholera, an acute diarrheal disease caused primarily by consumption of water or food containing toxigenic V. cholerae (serogroups O1 and O139), has essentially been eliminated in developed countries by treatment and distribution of safe potable water. Non-cholera Vibrio infections typically result from consumption of contaminated shellfish, commonly oysters, or from direct contact with contaminated water through recreation and occupational activities. Non-cholera Vibrio infections are characteristically from self-limiting gastroenteritis to severe life- threatenning necrotizing fasciitis, wound ear infection, and septicemia [7,8].

Infections in humans, such as cholera and non-cholera vibriosis, are brought on by Vibrio spp., which can be found in surface waters across the Americas, Asia, Europe, and Australia [9]. Numerous Vibrio species can be found in a variety of aquatic habitats, including rivers, estuaries, seas, and deep ocean waters. Vibrio presence may eventually be impacted by water conditions like temperature, pH, salinity, and nutrients in the water column as a result, several Vibrio species are seasonal and are frequently found during the height of summer: a higher temperature and less rain [10,11]. During the winter months, the bacterial cells are commonly found in a non-culturable stage [12]. For this reason, Vibrio can be used as a microbial indicator of climate change [13]. Despite the incidence of many cases of V. cholera and non-cholera in the world, the aim of this study highlight of Vibrio cholera and non-cholera in human and animals of Iraq.

2. EPIDEMIOLOGY

2.1. IN THE WORLD

Outbreaks of vibriosis are associated with increase temperature, warmer waters and extreme weather events. Vibriosis has been more common over the past several decades, and instances are being recorded to some far areas where there are no known cases of this illness and where the environment had previously been thought to be unfavorable to pathogenic Vibrio. One of the main causes of illness onset, particularly at places in high latitudes, has been identified as the high sea water temperature as a result of climate change [13,14,15]. The ecology of Vibrio has been associated with two main environmental factors: seawater temperature and salinity [16,17].

Epidemics of cholera are set on by isolates of serogroups O1 and O139, with O1 further subdivided into the biotypes classical (Cla) and El Tor (ET) [18]. Since 1817, there have been seven cholera pandemics in recorded history. The first six pandemics are thought to have been caused by the Cla biotype, but the seventh pandemic, which has been going on since 1961, is thought to have been caused by the ET biotype, which supplanted Cla internationally. First discovered in 1992 in India and Bangladesh, isolates O139 were later determined to be derived from the ET biotype and have not spread beyond Asia [19,20].

Global cholera epidemics can be driven on by *V. cholerae*, which produces the cholera toxin. For instance, non-toxigenic isolates have been linked to sporadic human infection in Latin America (serogroup O1 isolates) [21,22], Thailand (O27), Iraq (O53), and Japan (O48) [23,24,25], and reported to cause small-scale local outbreaks (less than 30 cases with O1) in India, Uzbekistan, Russia, and Fiji [26.27.28.29], as well as China [30]. Multi-locus sequences are now the primary pathogen transmitted by seafood and a source of health concern in the United States of America, New Zealand, Africa, Europe, and most Asian countries. Some non-toxic clonal complexes were geographically prevalent, according to typing data [31].

In low-income nations in 2020, the seventh cholera outbreak that began in 1961 will still be present. Outbreaks in Yemen in 2017 and Haiti in 2010 have brought the disease back into the spotlight on a worldwide scale. Despite the fact that outbreaks are relied on by variables including natural disasters, global warming, conflicts, and population growth [32].

Up until the 1960s, V. parahaemolyticus instances were confined to Japan, but starting in 1969, cases started to be documented all over the world. Since 1996, Following a sharp increase in the number of gastroenteritis cases in Calcutta and India, the epidemiology of infections caused by *V. parahaemolyticus* has changed. Unlike most previous outbreaks, the one in Calcutta was linked to a variant of the O3:K6 serotype containing the same virulence factor, the TDH toxin. This new strain, which has already been found on all continents and has become endemic in the areas it has reached, has swept across Southeast Asia in just one year. The global distribution of the *V. parahaemolyticus* O3:K6 strain may be influenced by a variety of factors, including climate change and ballast water from maritime shipping

[33,34]. Epidemiological report has shown that among seafood-born pathogens V. parahaemolyticus present a significant threat, and shrimp and finfish are high on the list of the most contaminated seafood [35].

V. vulinificus in South Korea reported 325 individuals with *V. vulnificus* infection, of whom 48.92% passed away between 2011 and 2016. One in seven patients with a V. vulnificus wound infection dies, according to predictions made in 2017 by the Centers for Disease Control and Prevention in the United States [36]. Independent of the method of infection, epidemiological statistics on *V. vulnificus* demonstrate that around 86% of the reported cases were men. According to this statistics, males have a six-fold higher risk of contracting *V. vulnificus* infection than females [37,33].

A study of vibriosis in Florida, United States (1998-2007), found V. alginolyticus as a relevant cause of infection, with 131 cases (almost 20% of all vibriosis infections) documented over this time period [38]. The incidence of these infections significantly rises during warmer months [14]. Most data indicate that ingestion of polluted sea foods and exposure to contaminated sea water caused V.alginolyticus wound infections [13]. Numerous sporadic reports of V. alginolyticus have also been documented in Europe [15]. Other types of Vibrio spp. including V. mimicus, V. cincinnatiensis, V. hollisae, V. furnissii, V. fluvialis, and V. metschnikovii, are linked to human infections. Although several different kinds of vibriosis can be set on by these clinically significant bacteria, these illnesses are rather uncommon. V. fluvialis, however, is increasingly being recognized as a new foodborne pathogen that poses a threat to the public's health [39,40].

2.2. IN THE IRAQ

Iraq has suffered an epidemic of the cholera disease over the past three decades [41]. This has gotten worse, especially during the first Gulf War in 1991, when cholera spread rapidly throughout all of Iraq's governorates [42]. Many Iraqi people suffered from the cholera disease between 2007 and 2009 [43]. Later, The presence of V. cholera O1 serotype (Inaba) was found and verified. V. cholera O1 serotype (Ogawa) detection and confirmation occurred for in 2012[44].

Changes in Iraq's climate may affect V. cholera outbreaks as well as the intensity, persistence, or appearance of these annual seasonal patterns, particularly in equatorial nations where higher and more stable temperatures may encourage a constant level of cholera outbreaks that occur mostly in the warmer months [45]. Also, due to the war, the majority of Iraq's wastewater treatment has not operated in accordance with ideal conditions. This has significantly increased the amount of *V. cholera* contamination in freshwater across the nation. Cholera cases have been reported between September 23 to November 6, 2015, 2651 Serogroup O1 (Inaba serotype) with a few cases of (Ogawa serotype), which affected different age groups and genders, was discovered and confirmed in Baghdad and in the other 14 Iraqi governorates [46]. As a result, the WHO advised that in order to limit V. cholera epidemics, it was necessary to upgrade water infrastructure, energy, and feces-disposal facilities in addition to improving physical and social conditions, particularly in refugee camps for the control of *V. cholera* outbreaks [47].

Vibrio spp. in animals have been isolated in Iraq from Basra shrimp V. alginolyticus was the predominant species, followed by V. cholerae, V. furnisii, V. diazotrophicus, V. gazogenes and V. costicola. The species of *Vibrio* were different between farms and this is may be related to the different source of larvae or different source of water [48].

Other Vibrio spp in human no case recorded, but only one case in Basra in 2018 reported in Iraq of V. parahaemolyticus according to the data of the Center for communicable disease control in Iraq. V. Cholera started outbreak in Iraq from 1967 was during 1967-1979 highest incidence in 1972 have been 1100 cases and between 1980-1989 started increase cases more than from previous years highest incidence in 1985 have been 1430. Outbreak between 1990-1999 also increase in 1998 and 1999 was have been 2560-2400 respectively. Also between 2000-2021 reached highest cases in 2007and 2015 was 4659-2868 respectively. In last two years 2020 and 2021 do not reported any cases V. Cholera then reported 1317 cases were reported in until Septemper 2022. Almost the reasons that led to an increase Cholera in Iraq in the years which the highest percentage was recorded are the result of wars, the economic circumstances, and internal conflicts and security turmoil in country.

These are two a chart the *cholera* epidemic in Iraq from 1967 to 2021 according to the data of the Center for communicable disease control in Iraq. As shown in the following (figure1,2).

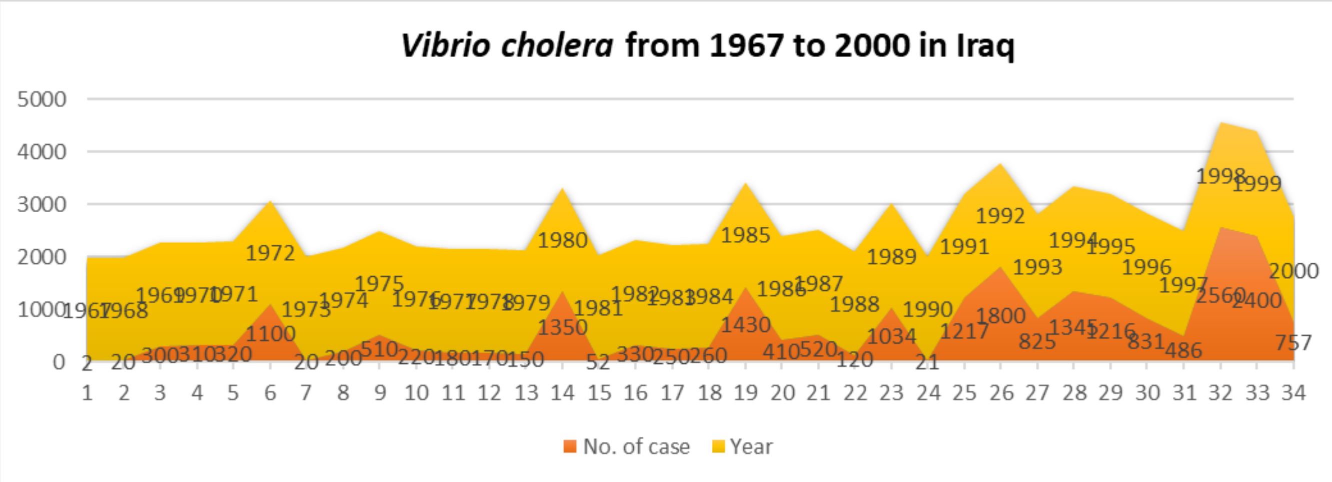

Figure 1. - Chart show Vibrio Cholera in Iraq from 1967 to 2000

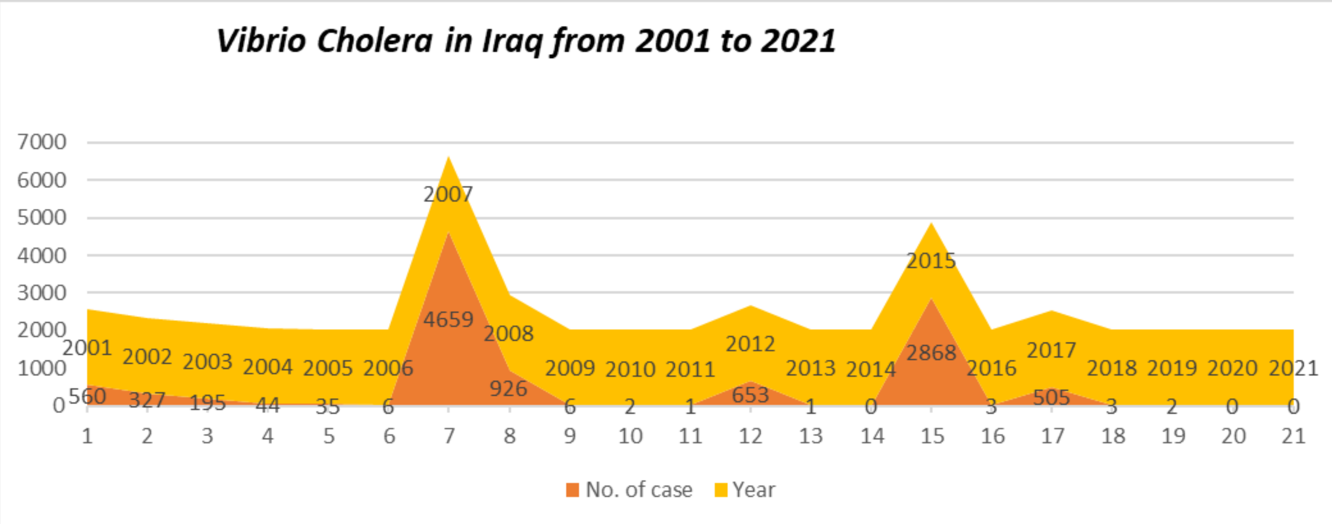

Figure 2. - Chart show Vibrio Cholera in Iraq from 2001 to 2021

In the last ten years was recorded cases in 2012, 2015 and 2017 in each governorate to show the highest cases in any governorate recorded showing as follows: -

In 2012, only eight governorates recorded cholera where the highest cases was recorded in sulaymaniyah governorate was has been ages more than five year % 48.23 and less than five year % 1.1 , then followed by Kirkuk governorate with proportion % 45.17 more than five year and less than five years % 3.52 then Dohuk governorate with % 0.3 more than five years, then Muthanna with % 0.3 more than five years and less than five years 0.61, then Diyala with %0.3 more than five years, then Salah al-Din, Wasit and Nineveh with %0.15 more than five years (Figure 3).

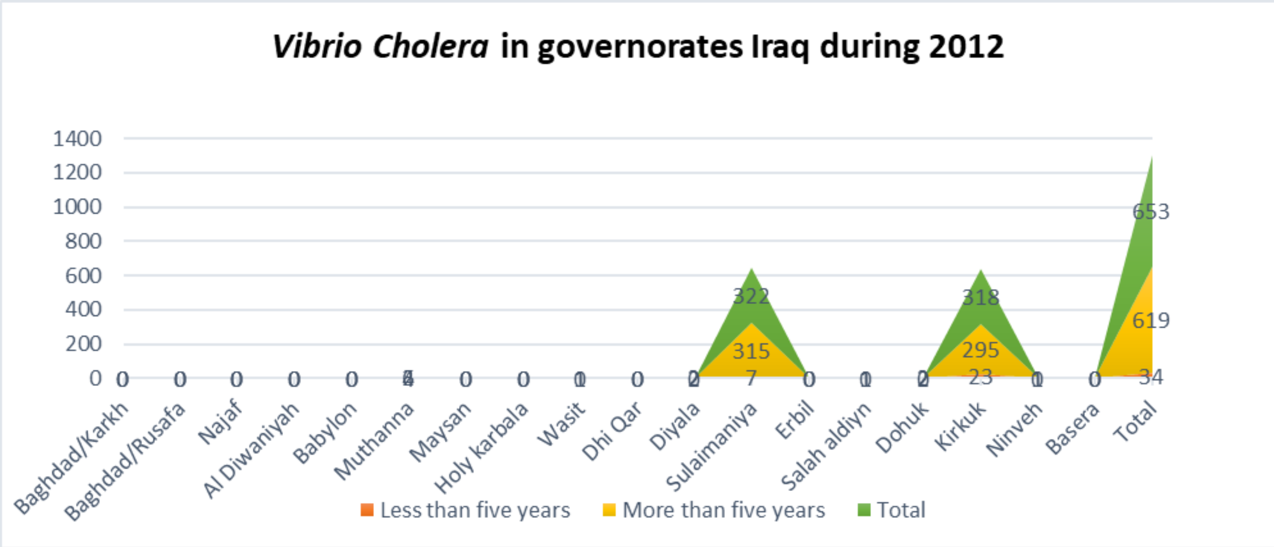

Figure 3. - **Chart show Vibrio Cholera in Governorates Iraq during 2012**

In 2015, all governorates of Iraq recorded cholera cases, where the highest rate was Babylon Governorate, which reached %23.5, and mortality was %0.03, followed by Baghdad/Rusafa, with the infection rate of %21.86, and mortality rate with %0.03, then Al-Diwaniyah %15.51, Baghdad/ Karkh %13.07 , Muthanna %10.1, Holy Karbala %5.5, Basra %3.6, Wasit %2.37 Najaf %1.6, Dhi Qar%0.73, Maysan %0.73 ,Kirkuk %0.66, Dohuk %0.5, Erbil %0.34, Diyala %0.1 ,Sulaymaniyah %0.06, Salah al-Din %0.06 ,Nineveh %0.03. Where the northern governorates had the lowest number of cases than the middle and southern governorates(Figure 4).

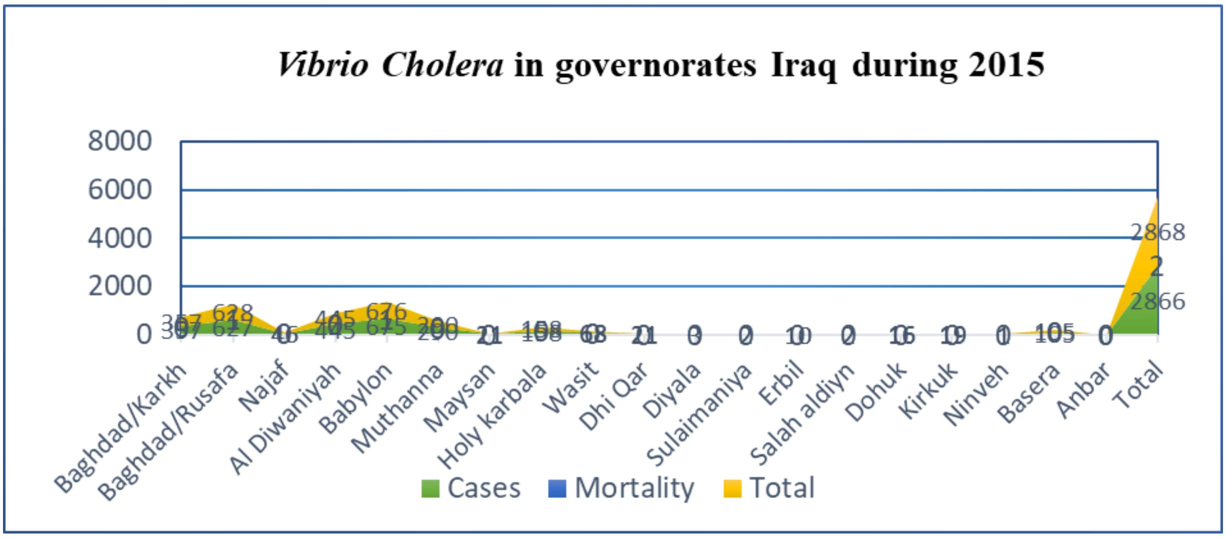

Figure 4. - **Chart show Vibrio Cholera in Governorates Iraq during 2015**

In 2017, Ten governorates were recorded with cases cholera. The highest governorate in cases was Baghdad, Al-Rusafa, which had 52.07% and mortality rate with 0.39%, followed by Holy Karbala with a proporation of 15.04%, Babylon 10.69%, Diwaniyah 10.09%, Wasit 4.55% and a carrier of the disease 0.19%, Muthanna 3.96, Nineveh 0.99%, Maysan 0.79%, Kirkuk 0.39% and with mortality rate 0.19%, Baghdad Al-Karkh 0.39% and Najaf 0.19% (Figure 5).

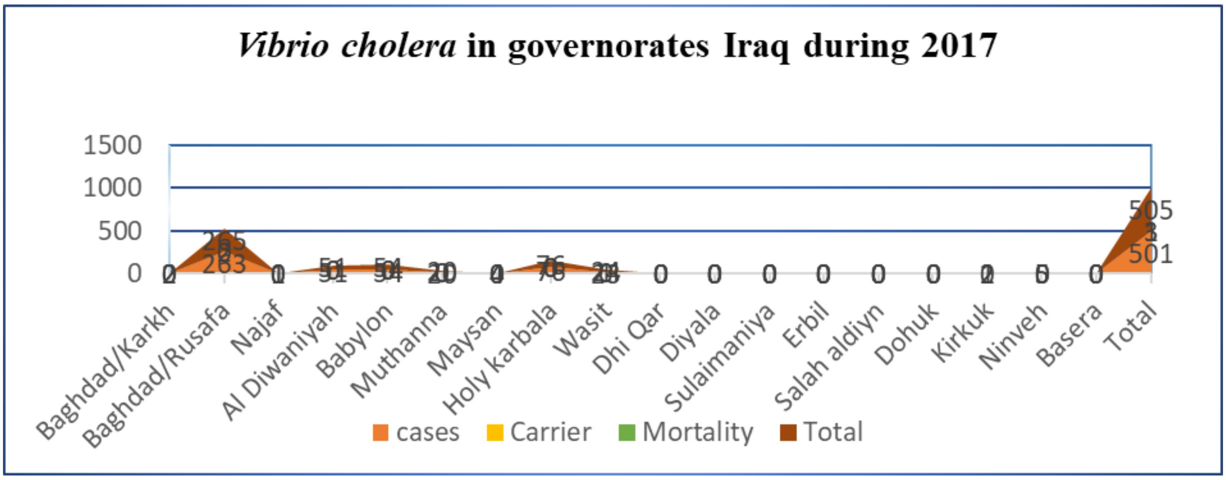

Figure 5. - **Chart show Vibrio Cholera in Governorates Iraq during 2017**

In 2022, governorates were reported with cases cholera. The highest governorate in cases was Kirkuk which had 48.89% and mortality rate with 0.22%, followed by Baghdad, Al-Rusafa with a proporation of 27.41% and mortality rate with 0.07%, Diyala 7.13% and mortality rate with 0.07%, Dhi Qar 4.93%, Wasit 4.85%, Najaf 2.27%, Holy karbala 1.29, Baghdad Al-Karkh 0.91%, Sulaymaniyah 0.75, Babylon 0.68 and mortality rate with 0.07%, Muthanna 0.37%, Salah al-Din 0,37%, Al-Diwaniyah 0.07%. (Figure 6).

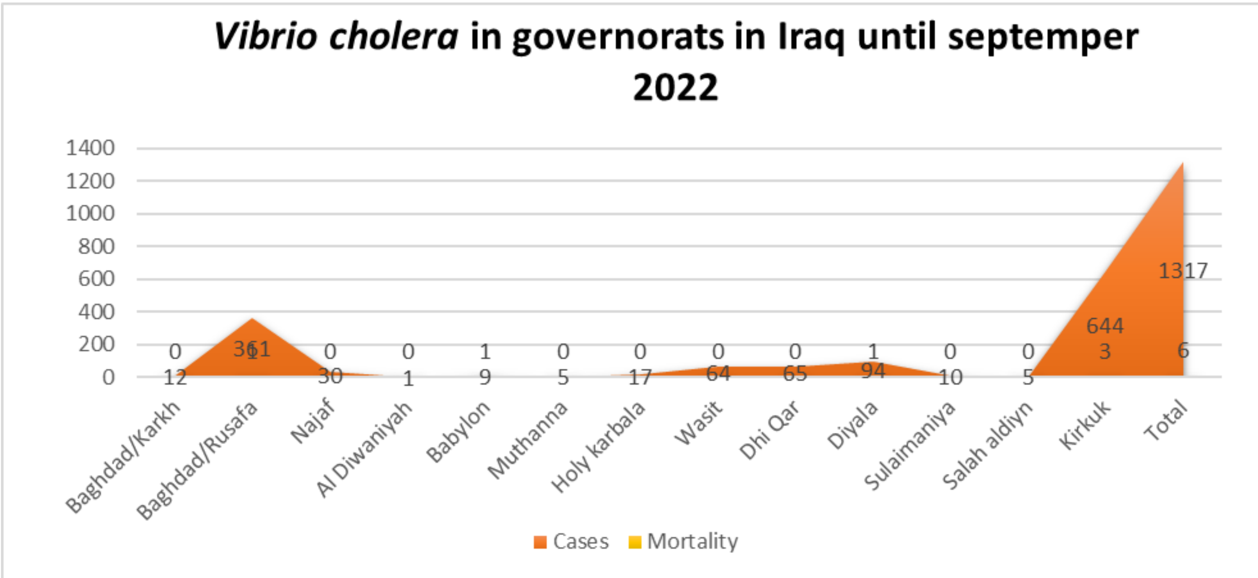

Figure 6. - **Chart show Vibrio Cholera in Governorates Iraq until septemper 2022**

3. CONCLUSIONS

Vibrio species are important because of their wide spread occurrence.V. Cholera and other *vibrio* species reported in many countries of the world but in Iraq only V. Cholera in human was recorded over five decades, but other of species Vibrio, no case was recorded, only one case in Basra by V. Parahaemolyticus in 2018. V. cholera rising incidence in 2007 and 2015 during five decades. In previous studies, it was show that other types of non-cholera *Vibrio* that were isolated from Iraq shrimp in Basra governorate are likely to be infected humans after consumption contaminated shrimp result many cases have recorded in countries of the world. It was concluded that the most important factors that led to an increase cholera in Iraq are climate change, wars, internal conflicts, and the lack of wastewater treatment.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest

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