Original Article

Evaluating the Status of Patients Suffering from Diarrhea During the Outbreak Occurred in Shahrekord in 2015

MoslemTaheri Soodejani[1], Seyyed Mohammad Tabatabaei[2], Mohammad Hassan Lotfi[1], Azimeh Ghaderi[3*], Seyyed Rashed Jazayeri[3], Ahmad Reisi[3]

1. Department of Biostatistics & Epidemiology, Faculty of Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran
2. Candidate in Medical Informatics, Faculty of Paramedical Sciences, Shahid Beheshti University of Medical Sciences, Tehran, Iran
3. ShahreKord Health Services Center, Shahre Kord University of Medical Sciences, Shahre kord, Iran

Received: 2015/09/28 **Accepted:** 2016/01/14

Abstract

Introduction: The term diarrheal diseases, a conventional expression, is neither regarded as an epidemiological subject nor a class of diseases, since diarrhea is a symptom of many diseases defined as the passage of three or more loose or liquid stools per day.

Materials &Methods: This is a cross-sectional study in which the records of all patients with symptoms of diarrhea encountering health centers were evaluated during April and May 2015.

Results: Females, with a frequency of 56.7%, revealed a larger proportion of clinical symptoms associated with this outbreak. Most of the clinical symptoms were related to watery diarrhea (74.5%), fever (62.4%), nausea (61.9%), vomiting (58.2%), and dysentery (24.2%). After fruits (51.6%) as the most common food which was eaten by people with clinical symptoms related to diarrhea outbreak, vegetables (42.9%), ice creams (4 %), food outside the home (3.5%), fast food consumption (2.4%) were eaten mostly.

Conclusions: The study findings demonstrated foods such as fruits and vegetables as the possible source of this outbreak, which were abundant in this province at spring. More attention, as well as better management and control on the food are needed according to World Health Day 2015: "from farm to plate, make food safe".

Keywords: Diarrhea, Epidemic curve, Outbreak, Shahrekord

* **Corresponding author:Tel:**+98 3832242376 **email:**azime4@yahoo.com

Introduction

Diarrhea is defined as the passage of three or more loose or liquid stools per day [2]. Actually, it is known as a symptom of many diseases [1].

The great prevalence of diarrhea has been reported all over the world, listed as a health problem, which causes great losses of life and property [3]. As a matter of fact, 3.1 billion cases of diarrhea and 2.3 million deaths from diarrhea are estimated in children under age 5 per year [4].Moreover, after respiratory infections, it can be regarded as one of the most important causes of death in the developing countries[5].

In Iran, at the beginning of diarrheal disease control programs (1986), national estimates indicated 70 million cases of diarrhea in children aged under the 5 years old each year, and thus, according to fatality rate, the annual deaths of 70, 000 children under 5 years with this disease was estimated. The first comprehensive national survey in October 1986 reported that the estimate of 70, 000 deaths per year was a large number and the deaths from diarrhea in 1986 included approximately 34, 000 children under 5 years. Today, it is estimated that about 22 million cases of diarrhea in children under 5 years occur each year and the resulting mortality rate has reached to less than 1, 500 cases per year[6].

A variety of factors such as population density, poor health facilities, limited information, malnutrition and specific social and behavioral conditions increase incidence of diarrhea in the developing countries [7].World Health Organization has determined the incidence of diarrhea as an indicator for assessing the status of regional water and sewage [8]. Generally, more than 80% of acute diarrhea is estimated to be caused by unsanitary disposal of waste and lack of personal hygiene [9].The problem gets worse when the disease becomes an outbreak or epidemic. It is called an epidemic when a disease, an event or a special behavior increases, often sudden, in the number of cases of a disease above what is normally expected, in the same area, the same population and the same time of the year [10].Epidemic of diarrhea caused by contaminated water or food occur every year around the world, especially in the developing countries [11].It seems that in the developing countries, the epidemic caused by shigellosis, contaminated food or water can play an important role in transmission of the disease, since sinkholes are located near wells in most of these countries[12].

Due to the occurrence of diarrhea outbreak in Shahrekord city at the beginning of the year, the present study aimed to evaluate the status of patients suffering from diarrhea during the outbreak as well as to report its results to the health system and the relevant authorities, so as better prevention programs could be devised against the outbreak.

Materials and Methods

This is a cross-sectional study in which the records of all patients encountering health centers with symptoms of diarrhea were evaluated during April-May 2015.An increase in cases of diarrheal diseases was reported from various sources in 2015 such as health centers, private clinics and hospitals. In fact, the outbreak was confirmed by experts and then was reported to the provincial health center and then to the CDC through phone.

Personnel of Shahrekord health centers gathered data related to this outbreak through a linear checklist which entailed important information about patients including name, phone number, place of residence, age, sex, birth place, job, onset date of disease, date of admission, date of recovery or death, common clinical symptoms (bloody diarrhea, watery diarrhea, nausea, vomiting and stomachache), laboratory diagnosis and history of disease as well as suspicious exposures. Ultimately, 1396 cases remained who had suffered from at least one of the diarrhea symptoms. The study data were analyzed using SPSS software through descriptive indicators, Chi-square test and related graphs.

Results

The initial evaluation of patients showed that most of the clinical symptoms were related to watery diarrhea (74.5%), fever (62.4%), nausea (61.9%), vomiting (58.2 percent), and dysentery (24.2%).Then, it was found that 56.7% of cases who had at least one of mentioned clinical symptoms were females and 43.3% were males. Most of the symptoms were found to be related to the age group of older than 21 years (58.2%) and age group of younger than 7 years (15.4%). The frequency of employment status in these cases is as follows: housewives (23.2%), students (18.3%), self-employed (10.2%). It should be noted that the largest frequency belonged to individuals aged younger than 7 years as well as the unemployed elderly (43.4%).

Analyzing the food eaten by patients up to three days before the onset of clinical symptoms demonstrated that the highest food consumption by the patients involved consumptions of the main meal (56.3%), fruits (51.6%), ice cream (4%), outdoor food (3.5%) and fast food (2.4%).67.1% of the cases, who referred to health centers and hospitals, were treated in an outpatient setting, whereas 32.9% were hospitalized to receive the better care.

In the next step to investigate the outbreak, clinical symptoms were evaluated with regard to age and sex which represented almost uniform distribution of clinical symptoms in both sexes and all age groups. Moreover, two age groups younger than 7 years and older than 21 had the most common clinical symptoms in both sexes. (Table 1)

Table1. Relative frequency (%) of clinical symptoms of patients referred to the health centers in terms of their age and sex

Clinical Symptoms	Sex	Age Groups(Years)					
		0-6	7-13	14-20	>21	Total	P Value
Fever	Male	65(18.1)	40(11.1)	51(14.2)	204(56.7)	360(100)	**0.03**
	Female	85(16.7)	73(14.3)	71(13.9)	280(55)	509(100)	
Nausea	Male	44(13)	36 (10.7)	52(15.4)	206(60.9)	338(100)	**0.01**
	Female	67(12.8)	63(12)	72(13.8)	321(61.4)	523(100)	
Vomiting	Male	54(16.1)	46(13.9)	46(13.9)	185(55.9)	331(100)	**0.01**
	Female	77(16)	59(12.3)	59(12.3)	285(59.4)	480(100)	
Dysentery	Male	24(15.4)	27(17.3)	30(19.2)	75(48.1)	156(100)	**0.12**
	Female	26(14.3)	22(12.1)	20(11)	114(62.6)	182(100)	
Watery diarrhea	Male	72(16.3)	51(11.5)	59(13.3)	260(58.8)	442(100)	**0.15**
	Female	91(15.2)	71(11.9)	77(12.9)	358(60)	597(100)	

The results of analyzing the employment status refer to clinical symptoms of patients who were affected by this outbreak, showed a similar distribution to the distribution of general symptoms, since all of symptoms, demonstrated the highest frequency in each group of unemployed people, housewives and self-employed ones(Table 2).

Table2. Relative frequency of clinical symptoms of patients referred to health centers with regard to employment status

Clinical Symptoms	Job Status					P value
	Housewife	Employee	Self-employed	Student	others	
Fever	185(21.2)	45(5.2)	85(9.8)	172(19.7)	384(44.1)	**0.13**
Nausea	222(25.7)	45(5.2)	96(11.1)	173(20)	328(38)	**0.01**
Vomiting	182(22.4)	37(4.6)	76(9.4)	153(18.8)	364(44.8)	**0.42**
Dysentery	73(21.6)	18(5.3)	30(8.9)	70(20.7)	147(43.5)	**0.64**
Watery diarrhea	245(23.6)	54(5.2)	110(10.6)	184(17.7)	447(43)	**0.60**

The results of checking clinical symptoms in separation of food which was eaten three days before their onset, were similar to general symptoms. As a result, the consumption of the main meal, fruits and vegetables had the maximum frequencies in regard to each symptom. (Table 3)

Table 3. Frequency (%) of clinical symptoms of patients referred to the health centers in regard with eaten food

Clinical Symptoms	Food intake(up to three days before the onset of clinical symptoms)					
	Ice cream	vegetables	fruit	Main Dish	Fast food	Food out
Fever	39(4.5)	384(44.1)	447(51.3)	485(55.7)	15(1.7)	24(2.8)
Nausea	28(3.2)	386(44.7)	447(51.7)	481(55.7)	18(2.1)	30(3.5)
Vomiting	25(3.1)	352(43.3)	420(51.7)	464(57.1)	21(2.6)	28(3.4)
Dysentery	16(4.7)	140(41.4)	182(53.8)	207(61.2)	6(1.8)	12(3.6)
Watery diarrhea	38(3.7)	452(43.5)	528(50.8)	568(54.6)	27(2.6)	37(3.6)

Regarding the disease status in terms of age groups a significant association between age and disease status was observed, as the proportion of hospitalized patients was more than outpatients only in age group of 0- 6 years, and the proportion of outpatients was more in other age groups(P=0.01). (Table 4)

Table4. Frequency (%) of hospitalization based on the age-groups

Age Groups	Disease Status			Chi square Statistics	P Value
	Outpatient	Hospitalization	Total		
0-6	100(45.6)	115(53.5)	215(100)	51.69	**0.01**
7-13	102(56.4)	80(43.6)	182(100)		
14-21	141(75.4)	46(24.6)	187(100)		
21<	593(73)	219(27)	812(100)		
Total	936(67.1)	460(32.9)	1396(100)		

Eventually, time distribution of frequency showed that clinical symptoms in patients contacted health centers started on 11th of April and then the number of visits of patients with clinical symptoms increased every day and reached to its maximum value on 20th of April (peak frequency). Then, the number decreased and finally, it reached to its minimum value on 4th of May (Diagram 1).

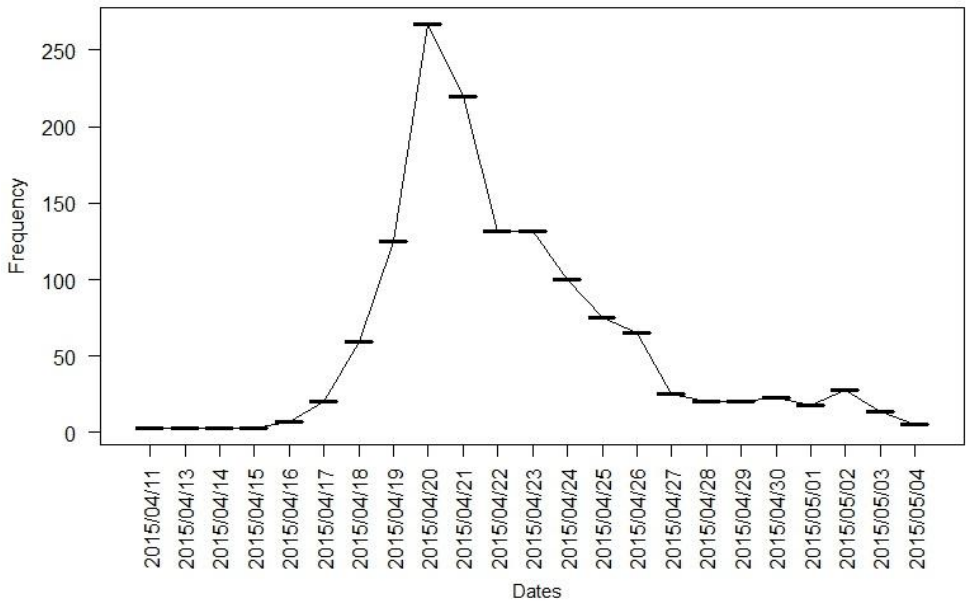

Diagram 1. Time distribution of frequency of clinical symptoms of patients referred to the health centers in Shahrekord

Discussion

Our study showed that the most observed symptoms during this outbreak consisted of acute watery diarrhea and associated symptoms of fever, nausea and vomiting. A smaller percentage of clinical protests referred to dysentery. The study of Masoumiasl et al.(2005), in line with these results, confirms the fact that the most prevalent o symptoms observed during the outbreak were acute watery diarrhea and associated symptoms of fever, nausea and vomiting [13].

Khaliliet al. (2007) conducted a study on hospitalized children with diarrhea, who proposed that the majority of hospitalized children had acute watery diarrhea and vomiting [14]. Due to the outbreak situation and its possible sources, such symptoms seem to be appeared by diarrhea-causing viruses. However, it is recommended to investigate further by designing an analytical study. Most of 1396 patients, who contacted the health centers, were females. In line with these results, the results of a study done by Karami et al. (2012) showed that females had a greater proportion of the disease [15]. Although this difference is not very sensible, it seems that women are more exposed to infection related to this issue, due to more work time in the kitchen and contact with the food.

Evaluation of different age groups indicated that in the group of older than 21 years, a larger frequency of clinical symptoms was observed which may be related to more population of this age group. Above3 remaining groups, higher proportion of symptoms is observed in the age group of

younger than 7 years. In line with these results, a study by Barati et al. (2010) can be mentioned which showed that symptoms of diarrheal disease decreases while age increases [16].Although, all age groups may be involved during an outbreak, children under 7 years seem to be more likely to respond to the disease, due to their physical condition and immunity system.

Regarding the employment status, the highest frequencies in the present study were related to students, housewives and the self-employed. However, cases younger than school-aged, cases with disabilities and retired ones were put in the category of "other "because of being unemployed, which demonstrated the maximum frequency.

In compliance with these results, Karami Joshin et al(2012) findings illustrated that the housewives and self-employed people reported maximum frequency of diarrhea-related symptoms[15].Although most people were placed in the category of "other" in this outbreak, due to being unemployed who were mostly children, self-employed and housewives groups displayed a significant percentage of symptoms incidence. Hence, it seems that job can be considered as an important factor in this regard.

History of food consumption up to three days before the onset of clinical symptoms was mentioned as another factor examined in this outbreak which indicated fruits and vegetables consumption as the most frequent within people, who referred to the health centers. A study conducted by Nissiet et al. (2013) showed that consumption of vegetables among patients with diarrhea was about 68% [1]. Moreover, Mahdi et al. (2008), in another study, revealed that consumption of vegetables is one of the risk factors of diarrhea with regard to its odds ratio value that was 4 .2 [17].

In a meta-analysis, regarding the risk factors for diarrheal outbreaks which was conducted by Eshrati et al.(2007) it was determined that consumption of fruits and vegetables which are not properly washed, is one of the major risk factors with an odds ratio of 75.2. Consumption of raw vegetables was also regarded as another risk factor that its odds ratio was determined 36.5 for the diarrheal diseases [18].In a case-control study conducted by Barati and et al., the consumption of fruit and vegetables with an odds ratio of 35.3 was demonstrated as an important risk factor in the incidence of diarrheal diseases [16].

All mentioned studies confirmed that the consumption of fruits and vegetables that had not been irrigated properly nor washed appropriately were involved in causing diarrheal diseases. More importantly, it seems that unhealthy water which is used to irrigate these products can be considered as a major cause of such outbreaks.

Analyzing the patients disease status in terms of age groups showed a significant association between disease status and the age groups (P = 0.000), so as individuals younger than 7 years were admitted more than other groups that represents their improper situation .Rahimi et

al. (2009) proposed that the majority of children admission occurred due to dysentery [19].It seems that children were more exposed to dysentery, which can be related to their immune status. Since children are at risk, they need hospitalization and care more than the people in other age groups.

One of the important factors in the study of outbreak which helps to discover the probable source of the outbreak is drawing time curve for incidence of symptoms called "epidemic curve". Such curves demonstrate incubation period and the distribution of outbreak over the time. After drawing the curve, it became clear that the outbreak have appeared as a common source epidemic.

Occurrence of such outbreak tells us that to find its possible sources we should study simultaneous and relatively short exposure of people with the same sources during that time. With regard to abundance of foods such as fruits and vegetables in the time of outbreak (spring), possible contamination of these foods can be caused by irrigation of these foods with unhealthy and contaminated water.

Conclusion

Although an analytical study needs to be designed(such as a case-control study)in order to explore the possible sources of this outbreak, , it seems that foods such as fruits and vegetables can be mentioned the possible source of this outbreak due to the drawn epidemic curve, which are abundant in this province at spring. As a result, more attention, as well as better management and control on the food are needed according to World Health Day 2015: "from farm to plate, make food safe".

Acknowledgments

We would like to appreciate efforts of all staff in the health centers of Shahrekord who has done splendid work in order to evaluate patients and collect the data during the outbreak.

References

1.Neisi AK,Sayadi F,mansourian M ,et al. Survey of Enviromental factors affected in diarrhea incidencein Tangestan Township of Boshehr Province in 2012. Tole-Behdasht. 2013;12(2):70-6 [Persian].

2. Diarroeha.Available from: http://www.who.int/topics/diarrhoea/en/. Access date: 25/10/2015

3. Malekfzali H. Evaluation of health programs in the past and present suggestions for future programs. Pajohesh. 1999;(2):63-6 [Persian].

4. Jafarzadeh M, Pourahmadi S. The survey of factors affected in children aqute diarrhea in immam reza and dr shaikh hospital in mashhad 2004. Sabzevar universi ty of medical sciences Journal 2005;7(1): 24-31[Persian].

5. Koohsar F, Amini A, Ayatollahi A, et al. The Prevalence of Intestinal Worms and Amebiasis in Gorgan (2005-2011,)Medical Laboratory Journal. 2013;7(3):54-60 [Persian].

6.Hosein H, Razavi SM, Eftekhar Ardebili H,et al. Texbook of Public Health. 3, editor. Tehran: Arjmand; 2012,pp:1273-83 [Persian].

7.Nikmanesh B, Oormazdi H, Akhlaghi L, et al. A survey of the prevalence of some agents particularly Cryptosporidium to produce diarrhea among children referred to Tehran Children's Medical Center. Razi Journal of Medical Sciences. 2007;14(54):193-202 [Persian].

8.Water Sanitation and Health (WSH).Facts and figures updated November 2004. Available from: http://www.who.int/water_sanitation_health/publications/facts2004/en/.

9.World Health Organization. The world report 2002. Oct. 2002. Available from: http://www.who.int/bookorders/anglais.

10.Hosein H, Razavi SM, Eftekhar Ardebili H, et al. Texbook of Public Health. 3, editoion. Tehran: Arjmand; 2012, pp:1011-1017 [Persian].

11.Behrman RE, Vaughan VC, Nelson WE."text book of pediatrics" 14dition. USA: McGraw Hill;1992: 45-6 [Persian].

12.Doupont HL. "Shigella Species" in: editor."Principles and practice ofinfectiousDiseases"5, London: Bacillary dysentery; 2000: 2363-8.

13. Masomi Asl H, Eshrati B, Hosseini Asl SMK, et al. Study diarrhea epidemic in the village of Chahar Mahal and Bakhtiari Province Farsan Dehcheshmaei city in July and August 2004. Infectious and Tropical Diseases Iran. 2005;10(28):11-4 [Persian].

14.Khalili B. Prevalence of Cryptosporidium and Risk Factors Related to Cryptosporidiosis in Hospitalized Children under 5 Years of Age Due to Diarrhea (Shahrekord- 2005). Armaghan-e- danesh. 2007;12(3):106-15 [Persian].

15.Karami M. Qom Cholera Outbreak in 2011: Influential and Determinant Factors. Iranian Jornal of Epidemiology. 2012;8(3):84-92 [Persian].

16.Barati H, Golmohmmadi A, Momeni I, et al. A Cholera Outbreak Investigation in Karaj District in 2008. Iranian Journal of Epidemiology. 2010;6(3):28-34 [Persian].

17.Mahdy AM, Lim YA, Surin J, et al. Risk factors for endemic giardiasis: highlighting the possible association of contaminated water and food. Transactions of the Royal Society of Tropical Medicine and Hygiene. 2008;102(5):465-70.

18.shrati B, Rezaei Ashtiani A, Khazaei F, et al. The association of a number of risk factors with the cholera outbreak of Markazi province in summer 2005.Iranian journal of epidemiology 2007; 3: 47-51 [Persian].

19.Rahimi M K, Elmbeigi P, Mousavi L, et al. Evaluation of patients with bloody diarrhea infection in Compylobacter Jejuni. Medical Azad University Journal. 2009;19(3):212-15 [Persian].