Diarrhea Among Children and the Household Conditions in a Low-Income Rural Community in the Jordan Valley

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Abstract

Objective: This study was conducted to explore the relationship between the occurrence of diarrhea in children and their household conditions in the Jordan Valley and to estimate the prevalence of diarrhea.

Methods: This was a cross sectional study. The multistage random sampling technique was applied. The sample included 197 children corresponding to 71 households randomly selected in the study area. A structured questionnaire was used to collect data in addition to observation. Diarrhea that occurred in the last two weeks before interview was the outcome variable. Household cleanliness and sanitary conditions were the primary independent variables measured in relation to diarrhea.

Results: Overall diarrhea prevalence was 21.3%, and among children< 5 years old was 19.1%. Significant factors (P<0.05) related to diarrhea occurrence included: mothers' age and education, crowding index, extended vs. nuclear family, family income, family size, household, toilet, and kitchen cleanliness, tap water availability, sufficient supply of drinking water, cleaning water reservoir, cleanliness of adjacent outdoor, and adequacy of septic tanks.

Conclusion: Mother's and family's characteristics in addition to household's sanitary conditions and adequacy of water supply were significant determinants of diarrhea occurrence.

Keywords: diarrhea, children, household conditions, Jordan Valley.

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Introduction

Diarrheal diseases remain a leading cause of preventable death, especially among children in developing countries. [1, 2] Globally, it is estimated that diarrhea causes the death of 1.5 million every year and accounts for 17% of all deaths in developing countries among children under-five years old. [1, 3] In the Eastern Mediterranean Region, diarrhea is the second most frequent cause of death among young children. [4]

Addressing diarrheal disease risk factors has the potential to reduce morbidity and mortality as well as the ancillary health impacts of repeated bouts of diarrhea, among them stunting and increased susceptibility to other diseases. [3]

Increasing evidence indicates that children are especially vulnerable and may be more exposed than adults to many adverse environmental factors including unsafe home conditions(e.g. infected contacts, infected domestic animals) and

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microbiological contamination of water, food, household surfaces and soil. [5-7] Diarrhea is commonly reported among poor families and can be manifested severely in children. [8] Therefore, reducing a child's exposure to biologic sources and reducing the contamination load from mechanical vectors, in addition to improving household conditions, could reduce the annual incidence of diarrhea in susceptible children. [6]

Diarrheal disease is considered to be the most important cause of infant morbidity in Jordan. [4] A recent national study in Jordan indicated that 16% of all children under age five had experienced diarrhea episodes at some time in the two weeks preceding the interview. [3] Although research in Jordan has been done, little attention has been given to the household environment and behaviors related to the children's health, especially in the Jordan Valley. This study aimed to provide knowledge based assessment of the household environment in relation to the occurrence of diarrhea among children in the Jordan Valley.

As Jordan's premier agricultural production area, the Jordan Valley in the west of Jordan is the narrow rift valley that contains the Jordan River. It extends from Lake Tiberius in the north to the Dead Sea in the south with a population around 140,000 and is characterized by high temperatures and low socioeconomic status.[10] This area has been for some time suffering from higher rates of infectious diseases including the 2004 Typhoid epidemic that occurred in Dir-Alla District [11] and malaria, [12] in addition to lower health indicators of children compared to other areas in Jordan.

This study employed a framework of behaviors exploring diarrhea in children as a result of the unsafe disposal of human feces, ingestion of contaminated water, and ingestion of contaminated food. These behaviors were explored because they are relevant to a child's survival, have the potential to impact health, and are feasible to study. Studies that investigated household conditions have reported that low scores for kitchen hygiene and overall household cleanliness were strongly associated with the high risk of severe diarrhea in children.[13, 14] Programs integrating water, excreta disposal, and hygiene education can achieve 35-50% reductions in diarrhea morbidity. [13]

Methods

Study design

This study stems from a comprehensive project that aimed to evaluate the impact of environmental factors on the health and social status of people in the Jordan Valley. The present study was a cross sectional survey carried out during a period of one month to assess the diarrhea status among children. The multistage random sampling technique was applied. Ethical and institutional approvals were obtained from the "Committee of Ethics in Scientific Research" at the Jordan University of Science and Technology (JUST) and the Jordanian Ministry of Health (MOH).

Study participants

The target population was the residents of Al-Sheikh Hussein area about 80 km north-west of the capital, Amman with a total population of 7,000. The sample size and block identification was determined and provided by the Jordanian Department of Statistics (DOS). The original sample included 315 households who were approached, but ten households declined, so the response rate was 96.8%. The first stage included composing a list of the population in the study area by blocks and households. The procedure carried on by randomly selecting and contacting every third household proportional to population size and then obtaining consent from each household's head. For the purpose of the present study, a subsample of 120 households that had children in ages ranging from 0 to 13 were invited to the health center for stool analysis and data collection completion, among which 71 households showed up, including 197 children who constituted our sample.

Measurements

A structured questionnaire in Arabic language was developed and tested with 10 households (not included in the sample) and modified as necessary before the data collection. Questions were of a yes/no or multiple choice type. The questionnaire was validated by three experts in the fields of public health and environmental health. It included items related to sociodemographic background, household conditions, and diarrhea occurrence in children under or at 13 years of age in the two weeks prior to data collection to minimize recall bias. Questions on diarrhea included manifestations of the diseases. The main independent variables were related to hygienic behaviors, sanitation, and ingestion of safe food and water. Questions relating to household conditions and behaviors included the cleanliness of indoor areas and outdoor areas surrounding the household, method of sewage disposal, toilet conditions, quality and quantity of drinking water, sanitation of the hands of the mother and her children, cleanliness of water containers, and garbage disposal methods. Drinking water quality and quantity were judged according to responses reported by household heads. The question on drinking water explored if the people perceived the quality as bad, moderate, or good and the quantity as sufficient, moderate, or insufficient. Diarrhea was defined as having loose or watery stools at least three times per day or more frequently than normal for an individual. [1]

Data collection

Face-to face interviews using a structured questionnaire were conducted with mothers in the 120 households. All interviews were conducted by assistants who were trained about the interview and questionnaire. The cleanliness of the households in general and the kitchen, toilets, and outdoors were measured separately for each, which was emphasized during the data collection preparations to avoid observer bias. In addition, observations of septic tanks were performed. A two-point scale of 'adequate' or ' inadequate' or a three-point scale of 'bad', 'moderate', or 'good' were used for assessing individual and household cleanliness and behaviors.

Stool specimens collection

During the household survey, children who were reported by parents as suffering from acute diarrhea in the last two weeks were identified. Parents of these children and parents of others without diarrhea were asked to bring their children the next day to the health center at the Ministry of Health (MOH). Stool specimens were collected from 8 am to 2 pm the same day, kept in a cold refrigerator for 2 to 8 hours, and given a routine stool analysis.

Statistical analysis

The data were analyzed using SPSS, version 15. Data were presented as simple frequencies and percentages. The significance of differences between proportions was tested using the Chi-squared test, with $P < 0.05$ as significant. A relationship was explored between the outcome variable (reported diarrhea) and socio-demographic variables and household characteristics and behaviors. In addition, the mother's education was further explored for determinants due to its importance in a child's health protection. A T-test was used to test the difference between means.

Results

Table (1) presents diarrhea prevalence, symptoms and the results of a stool analysis for 197 children, of whom 21.3% reported having diarrhea in the last two weeks before the interview, while 155 (78.7%) were disease free. Diarrhea prevalence in children under five years old was 19.1%. Routine stool analysis of the 42 children who reported having diarrhea revealed 45.3% did not have any pathogens, while 54.7% had pathogens related to diarrhea (Entamoeba histolytica, Giardia lamblia, and fungus), pathogenic parasites not related to diarrhea (Ascaris, Enterobius vermicularis*)* and non-pathogenic parasites (Entamoeba Coli).

Table (2) shows children's socio-demographic background. The median age of children was 5.0 years old (±3.8 SD) and 47.7% were under 5. Females represented 49.2%. Most mothers (70.0%) were in the age groups 20-39 years old (mean age =36.4), unemployed (94.9%), and had 12 or less years of education (72.6%). Illiterate mothers comprised 16.8% of all mothers in the sample. Most families had income lower than 250 JD ($353) (86.8%) and a family size of 6-10 members (65.0%) and were a non-extended family type (87.0%). Significant socio-demographic variables in relation to diarrhea occurrence included the mother's age P=0.003 and education P=0.006, crowding index (family size / hnumber of rooms in household) P=0.000, family type P=0.004, family income P=0.04, and family size P=0.01. On the other hand, the mother's education was associated with employment P= 0.000, high family income P= 0.000, low parity P= 0.01 and family size P= 0.004, clean toilets P=0.026, clean households P=0.028, and clean kitchens P=0.004.

Household characteristics are described in table (3). Electrical power was connected in 97%, piped drinking water in 95% (from the Water Authority), almost all households (99%) had adequate drinking water reservoirs and 78% regularly cleaned them, while only 56.8% and 29% perceived their water quality and quantity as good, respectively. More than 83% of households disposed of waste water in sinks. Since the Jordan Valley lacks a public sewage system, most residents have a septic tank. In this study, 78.6% said they had an adequate septic tank.

Most families (72.6%) in the sample lived in residences consisting of at least four rooms, and 31.5% had bad or moderate household hygienic conditions. Kitchens and toilets were described by research assistants as bad or moderate in 38.5% and 46.2%, respectively. All mothers in this sample reported washing their hands and their children's regularly, and 98% dispose of garbage in the designated municipality containers. More than 39% of the outdoor areas surrounding households were in bad to moderate hygienic condition, with 77.6% of families raising farm animals inside their residential areas. Significant household variables (characteristics and behaviors) associated with diarrhea occurrence in children included household cleanliness (P=0.000), toilet cleanliness (P=0.000), kitchen cleanliness (P=0.003), tap water availability (P=0.02), drinking water quantity (P=0.00), frequency of water reservoir cleaning (P=0.01), cleanliness of area adjacent to household (P=0.00), and adequacy of septic tanks (P=0.01).

Table (1): Prevalence of diarrhea, manifestations, and stool analysis.

	n (%)
Diarrhea prevalence	*42 (21.3%)*
Diarrhea symptoms	
Watery diarrhea	*35(83.3)*
Bloody diarrhea	*4(9.5)*
Fever	*27(64.3)*
Stool analysis results	
Ascaris Lumbricoides	*1(2.4)*
Giardia Lamblia	*3(7.1)*
Entamoeba Coli	*3(7.1)*
Entamoeba Histolytica	*5(11.9)*
Enterobius Vermicularis	*6(14.3)*
Fungus	*5(11.9)*
No microorganism detected	*19(45.3)*

Table (2): Children socio-demographic background.

Variable	*Diarrhea n= 42 (%)*	*No diarrhea n=155 (%)*	*Chi-Square P-value*
Child' age			*0.477*
<5 years	*18 (42.9)*	*76(49.0)*	
5-13 years	*24(57.1)*	*79(51.0)*	
Child's gender			*0.351*
Female	*18(42.9)*	*79(51.0)*	
Male	*24(57.1)*	*76(49.0)*	
Mother's age			*0.003*
20-29 years	*15(35.7)*	*40(27.2)*	
30-39 years	*24(57.1)*	*53(36.1)*	
40-49 years	*3(7.1)*	*37(25.2)*	
≥50 years	*0(0)*	*17(25.2)*	
Mean mother's age (total=36.4)	*31.8*	*37.7*	*0.000 **
Mother's education			*0.006*
Illiterate	*0(0)*	*26(16.8)*	
≤12 years	*38(90.5)*	*105(67.5)*	
2-4 years college	*4(9.5)*	*24(15.5)*	
Mother works			*0.492*
In agriculture	*3(7.1)*	*7(4.5)*	
Unemployed	*39(92.9)*	*148(95.5)*	
Family income in Jordanian Dinars (JD)			*0.043*
0-100	*9(21.4)*	*26(16.8)*	
101-250	*33(78.6)*	*103(66.5)*	
251-450	*0(0)*	*18(11.6)*	
>450	*0(0)*	*8(5.2)*	
Mean family income (total=186.6)	*151.1*	*196.2*	*0.000 **
Family size			*0.014*
2-5	*10(23.8)*	*40(25.8)*	
6-10	*23(54.8)*	*105(67.7)*	
≥ 11	*9(21.4)*	*10(6.5)*	
Mean family size (total= 7.0)	*7.95*	*6.8*	*0.000 **
Crowding index			*0.002*
≤ 1.2	*0(0)*	*26(16.8)*	
1.3-2.5	*15(35.7)*	*67(43.2)*	
2.6- 4.0	*17(40.5)*	*49(31.6)*	
> 4.0	*10(23.8)*	*13(8.4)*	
Mean crowding index (total=2.44)	*2.6*	*2.4*	*0.000 **
Family type			*0.004*
Extended	*11(26.2)*	*14(9.3)*	
Not extended	*31(73.8)*	*137(90.7)*	

**** T-test for the two means***

Table (3): Household characteristics and behaviors.

Variable	*Diarrhea n= 42 (%)*	*No diarrhea n=155 (%)*	*Chi-Square P-value*
Number of rooms			*0.562*
1-3	*13(31.0)*	*41(26.5)*	
≥4	*29(69.0)*	*114(73.5)*	
House cleanliness			*0.000*
Bad	*11(26.2)*	*7(4.5)*	
Moderate	*5(11.9)*	*39(25.2)*	
Good	*26(61.9)*	*109(70.3)*	
Toilet condition			*0.000*
Bad	*12(28.6)*	*7(4.5)*	
Moderate	*20(47.6)*	*52(33.5)*	
Good	*10(23.8)*	*96(61.9)*	
Kitchen cleanness			*0.000*
Bad	*13(31.0)*	*10(6.5)*	
Moderate	*8(19.0)*	*45(29.0)*	
Good	*21(50.0)*	*100(64.5)*	
Household smells			*0.000*
Bad	*15(35.7)*	*16(10.3)*	
Moderate	*17(40.5)*	*44(28.4)*	
Good	*10(23.8)*	*95(61.3)*	
Household ventilation			*0.000*
Bad	*13(31.0)*	*8(5.2)*	
Moderate	*15(35.7)*	*44(31.0)*	
Good	*14(33.3)*	*99(63.9)*	
Outside house cleanness			*0.006*
Bad	*9(21.4)*	*10(6.5)*	
Moderate	*14(33.3)*	*44(28.4)*	
Good	*19(45.2)*	*101(65.2)*	
Tap water inside residence (piped)			*0.010*
Yes	*37(88.1)*	*151(97.4)*	
No	*5(11.9)*	*4(2.6)*	
Tap water quality			*0.561*
Bad	*0(0)*	*4(2.6)*	
Moderate	*17(40.5)*	*141(41.3)*	
Good	*25(59.5)*	*87(56.1)*	
Tap water quantity			*0.024*
Insufficient	*25(59.5)*	*115(74.2)*	
Moderate	*14(33.3)*	*23(14.0)*	
Sufficient	*3(7.1)*	*17(11.0)*	
Cleaning water reservoir			*0.012*
Yes	*36(85.7)*	*149(96.1)*	
No	*6(3.9)*	*6(3.9)*	
Waste water disposed			*0.183*
In sink	*38(90.5)*	*127(81.9)*	
Outside	*4(9.5)*	*28(18.1)*	
Septic tank			*0.011*
Adequate	*39(92.9)*	*116(74.8)*	
Inadequate	*3(7.1)*	*39(25.2)*	
Raising animals around			*0.796*
Yes	*10(23.8)*	*34(21.9)*	
No	*32(76.2)*	*121(78.1)*	

Discussion

For this area specifically, baseline data or previous studies were not available for comparison, so all of Jordan and other nearby countries' results were reviewed. Our results indicate that the prevalence of diarrhea among children in the study area (21.4%) is higher than that reported for all Jordan (16%). However, higher rates of diarrhea have been reported in other areas of Jordan (e.g. Al Karak 22.4%). [9] On the other hand, studies in the neighboring countries have reported lower rates of diarrhea among children of Palestinian refugees (13.7%),[14] and Saudi Arabia (14.9%),[15] excluding Iraq (24.4%). [16] The high prevalence of diarrhea in the present study can be explained by the fact that this study area is underserved and lacks initiatives for sustainable development in respect to employment, education, and sanitation. In our study, diarrhea in children was measured as reported by parents, the same approach used by other studies. [6, 13-15] Overall rates of diarrhea in Jordan have declined in the last 20 years, which may be connected to the construction of infrastructure for adequate water and sanitation.[9,12] In the present study, the sex and age of the children were not important factors in diarrheal disease occurrences. Results of many previous studies were inconsistent regarding these two variables. [6, 18, 19] Our results indicate that mother's education was a significant factor associated with diarrhea among children. The status of the mother's education was a unique risk factor for diarrhea that was very meaningful. The mother's education has been reported as an essential determinant of a child's health, associated with hygienic behaviors and family feeding practices. [17] Many studies have indicated that the frequency of diarrheal diseases decreases significantly as the education level of the mother increases. [17-19] Besides, as our results show, a better educated mother was associated with better family income, low parity, small family size, less unemployment, and better overall cleanliness (household, kitchen, toilet). Poverty has been related to unemployment, crowdedness, poor interactions, which all reflect on a family's health status. [6, 19, 20] Family income was significantly related to the occurrence of diarrhea in this study. This study took place in a predominantly poor area, where the average family income is at or below 250 JD per family per month, which is below the average poverty line in Jordan. [9] Sufficient family income has been reported as a main factor leading to better health outcomes. [19] The family size in this study (7.0 for the total sample and 7.9 for the diarrhea group) was higher compared to Jordan's 2007 survey (5.3 for Jordan and 5.7 for rural). [9] In addition, the crowding index among the diarrhea group was 2.6, which is significantly higher than the average 2.4 (P=0.000), and higher than that reported in other studies. [14] Overcrowding manifested in our study by a higher crowding index (CI >1) which has been associated with unhygienic behaviors and illnesses as shown in other studies. [1, 14, 21]

The overall household's cleanliness including toilet and kitchen had a highly significant association with diarrhea occurrence. Similar associations were detected in other studies. [13,14,19,21] The importance of living conditions, clean water and a regular sewer on diarrheal diseases has been documented by different studies. [13, 14, 21] Among the contributors to diarrhea in children, the household health environment, living standards, and mother's cleaning behaviors play important roles. Women play a major role in making or breaking the 'chain of contamination' within the household's sphere. [21] Diarrheal diseases are related to water, hygiene, food, and sanitation and have multiple oral fecal transmission routes. [21] In this study, a significant association was detected between the prevalence of diarrhea in children and the availability of tap water. The water quality was not a concern for the families, yet the water quantity was absolutely poor for more than 76% of the families in the sample and was associated with diarrhea. Inadequate supply of drinking water was proven to be a risk factor for diarrhea and other diseases, while sufficient clean water enabled families to live in a sanitary environment, according to findings reported in previous studies. [13-16, 21, 22]

Regular cleaning of water reservoirs and having adequate septic tanks were important behaviors that were associated with a reduction in diarrhea in this study; similar findings were reported in other studies. [14-16]

Diarrheal disease in Jordan is aggravated by the state of water. The fresh water supplies of Jordan are scarce and strategically critical. The average share is 156 liters/citizen/day, one of the lowest in the Middle East, and the 4th poorest country in water resources in the world. Acute water scarcity compounded by a relatively high population growth rate is considered an important constraint to sustainable development and health. The water scarcity is exacerbated by pollution including insufficient management of wastewater which constitutes a serious threat to health. Water is provided intermittently with supply frequency of once a week for 12 hour duration with inadequate distribution systems. [12] The fact that household cleanliness and water supply were very important determinants for diarrhea points to the need for health education to raise awareness and the regular supply of drinking water. [13] Reducing childhood diarrhea requires interventions to make children healthier and less likely to develop infections that lead to diarrhea; clean environments are less likely to transmit disease. [3] Evidence indicates that appropriate water, hygiene, and sanitation interventions can reduce diarrhea incidence by 26% and mortality by 65%. [23]

Strengths and limitations

This study is the first in Jordan to relate household conditions to the occurrence of diarrhea in children in the Jordan Valley. Observations of household cleanliness and behaviors in addition to the mother's verbal information enabled better assessment. There were some limitations to this study. Recall bias may have occurred in assessing the prevalence of diarrhea. Under- or over-estimation of the diarrhea cases may have occurred due to the individual judgment of the mother regarding diarrhea in her children. Despite adequate training, research assistants who performed household assessments may have introduced a bias or inconsistency in measurements. Therefore, we performed data checks during data collection and analysis to ensure accuracy. The small sample size of the children and the data collection approach that relied on the mothers' recollections limited the ability to draw wider conclusions regarding handwashing or other hygienic behaviors. In addition, there were insufficient data of water quality and quantity, so no linkages were made with diarrhea outcomes for each household.

Conclusion

In conclusion, the results of this study clearly shows that household sanitary conditions and water were significant determinants of diarrhea occurrence reported by the parents of the children. A better water source does not accomplish full health benefits if it is not accompanied by improved sanitation and better practices of water storage.

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الإسهالات بين الأطفال وارتباطها بالظروف البيتية في مجتمع قروي متدني الدخل في وادي الأردن

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الملخص

الخلاصة: تهدف هذه الدراسة إلى استكشاف العلاقة بين حدوث الإسهالات عند الأطفال والظروف البيتية في وادي الأردن، إضافة إلى تقدير نسبة الإسهال.

الطريقة المنهجية: تعدّ هذه دراسة وصفية مقطعية، استخدمت المراحل المتعددة لجمع عينة عشوائية منتظمة. اشتملت العينة على 197 طفلاً يسكنون في 71 منزلاً تم اختيارها على نحو عشوائي في منطقة الدراسة. تم استخدام استبيان مركب لجمع المعلومات، إضافة إلى طريقة المشاهدة العينية للظروف البيتية. تم تعريف الإسهال على انه أي إسهال ظهر عند هؤلاء الأطفال خلال الأسبوعين السابقين لبداية جمع المعلومات والمقابلة، بينما اعتبرت الظروف الصحية والعادات المتبعة في البيت متغيرات مستقله لدراسة علاقتهم بظهور الإسهال.

النتائج: النسبة الكلية للإسهالات كانت 21.3%، بينما كنت النسبة بين الأطفال الذين تقل أعمارهم عن 5 سنوات 19.1. وكانت العوامل التى لها علاقة إحصائية (بنسبة 95%) مع الإسهال، هي: عمر الأم وثقافتها، ومؤشر ازدحام المنزل، ونوع الأسره من حيث كونها ممتدة أو محدودة، ودخل الأسره، وحجم الأسره، ونظافة المطبخ والحمام، وتوافر مياه الحنفية على نحو كاف، ونظافة مخازن مياه الشرب، ونظافة المنطقة المحيطة بالمنزل، ومطابقة الحفرة الامتصاصية للشروط الصحية.

الاستنتاج: إن ثقافة الأم وخصائص العائلة، إضافة إلى الظروف البيتية غير الصحية وعدم توافر مياه الشرب جميعها أسهمت في ظهور الإسهال.

الكلمات الدالة: إسهال، أطفال، الظروف البيتية، وادي الأردن.