ASSOCIATION OF HYGIENE PRACTICES AND DIARRHEA PREVALENCE IN CHILDREN: A COMPARATIVE STUDY AMONG CHILDREN OF EDUCATED AND UNEDUCATED MOTHERS

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ABSTRACT

Objective: To investigate the association between the incidence of acute diarrhea in children and the hygiene practices of mothers residing in Peshawar along with the comparison of association of educated and uneducated mothers.

Study Design: A case-control study.

Place and Duration of Study: Combined Military Hospital (CMH), Peshawar, from Jul 2014 to Dec 2014.

Material and Methods: Data was analyzed on 363 children, aged 2 to 5 years, out of which 121 were cases with diarrhea and 242 were healthy controls. Structured questionnaire was given to mothers. SPSS version 22 was used. To compare the association of hygiene practices with acute diarrhea, chi square test at 5% level of significance was applied. A p-value<0.05 was considered as statistically significant. Stratified chi square test was applied to compare the association of various risk factors with acute diarrhea among educated and uneducated mothers.

Results: The risk of diarrhea was significantly higher in children whose mothers were poorer in hygiene practices (p<0.01). Surprisingly, it was also observed that mothers using water from filter were more prone to develop diarrhea and other diseases (64.3%). When lavatory system, water sources, bottle washing techniques were compared in uneducated groups (p=0.48, p=0.32, p=0.32) and educated group, there was significant difference of association in educated group only (p<0.01). However, regarding the hand washing habits of children as well as mothers of children with acute diarrhea, no difference of association was observed educated and uneducated groups (p<0.01).

Conclusion: Lack of hygiene practices among mothers especially the uneducated group is a major risk factor for diarrhea in children among CMH Peshawar. Health awareness programs and developing resources for improved sanitation are the main methods to reduce this burden.

Keywords: Children two to five years of age, Diarrheal disease, Hygiene practices, Maternal education.

INTRODUCTION

Diarrhea is the second leading cause of death in underfive children worldwide with majority in South Asia and Africa[1]. Pakistan ranks second after India for under-5 mortality rate in South Asian countries[2]. The healthcare system of Pakistan is still much neglected. According to World Health Organization (WHO), Pakistan ranks 130th among 191 countries of the world in health system performance measurement[3]. Many studies have the consensus that child morbidity and mortality requires explaining the interactions among many factors such as behavioral, socio-economic and environmental[4]. Although there has been progress in the reduction of diarrhea-associated mortality[3], the reduction in incidence and morbidity has varied in different regions and socio-economic classes. Several factors are likely to contribute to the very high diarrhea morbidity and mortality rates, including poverty, female illiteracy, poor water supply and sanitation, poor hygiene practices, and inadequate health services which can be prevented by means of simple public health interventions[5].

Although diarrheal disease is recognized as a major problem in Pakistan few studies on this

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issue have been conducted at the community level. Risk factors for childhood diarrhea vary by population with some factors being more important than others in particular settings. Most of these associations have been established through studies developed primarily in industrialized nations[6]. Further efforts need to be put into identifying the basic causes of illness in the fight against child mortality. It is important to identify the distinct risk factors for diarrhea in a particular target population so that the local intervention programs, planned and implemen-ted could be tailored to target them.

Improving domestic hygiene practices is potentially one of the most effective means of reducing the burden of diarrhea in children[7]. The most common cause of childhood diarrhea mostly is lack of safe water, basic sanitation, and hygiene accounting for about 88% of the disease burden due to diarrhea[8]. It is important to study the linkage between household practices and diarrhea morbidity among under-five. Inadequate hand hygiene practices have been estimated to affect 80% of the population globally[9]. Although the incidence of water borne infectious diarrhea among children in developing countries is very high, evidence of scientifically sound studies such as randomized controlled trials is inadequate.

Since mothers are primary caregivers of under-five children, healthy practices adopted by them can raise the healthful living condition thereby lessening the morbidity and mortality. Mother's literacy influence their hygiene and feeding practices towards children[10]. Many studies have highlighted the association of maternal education with childhood diarrhea[11]. It is expected that educated mothers should improve child health because education has been connected to family socioeconomic situation, which in itself is a determinant of child health[12]. However education does not act in isolation but interacts with other important factors and, depending on the context, it may or may not generate social benefits. Very few studies have investigated the relationship between maternal education and diarrhea in children in Pakistan. Therefore, this study was implemented to fill the gap.

The objective of this study was to determine association between sanitary conditions and hygiene practices of mothers with occurrence of diarrhea in young children visiting CMH hospital, Peshawar. The data was further stratified by maternal education to get a comparison of hygiene practices and diarrhea among educated and uneducated mothers. The study will help highlight the target areas to be focused by health planners aiming to reduce the burden caused by diarrhea among children less than five years of age in the district.

MATERIAL AND METHODS

A case-control study was conducted in Combined Military Hospital (CMH), Peshawar from July 2014 to December 2014. The cases were selected from the Family Outpatient Department FOPD of CMH while the controls were selected from the Immunization center of CMH and FOPD of CMH.

In this case-control study, the cases comprised of children, 2-5 years of ages, who were confirmed to be cases of acute diarrhea based on the confirmation by history taking. Children with chronic diarrhea, any other disease or severely malnourished were excluded from the study

Children between 2 to 5 years of age confirmed to be healthy and not suffering from acute diarrhea based on history and sign and symptoms. It was also ensured that the child had no other medical or surgical morbidity.

Using WHO sample size calculator, minimally required sample size was calculated for study as follows:

- Level of significance = 5%
- Power of the test = 80%
- Test value of the Odds ratio = 1
- Anticipated probability of the exposure given disease = 0.2754.(60)
- Anticipated probability of the exposure given no disease = 0.1432

- Anticipated Odds ratio = 2.27(60)
- Minimally Required Sample Size = n = 121 in each group.
- Hence total children included were 363 in total amongst whom 121were cases with diarrhea and 242 were healthy controls (children without diarrhea) keeping cases to control ratio as 1:2.

Those units of the population that were fulfilling the inclusion criterion were selected in the sample using non-probability consecutive sampling. Parents of young ones (2 to 5 years old) with complaint of uncomplicated diarrhea for less than 7 days duration to CMH Peshawar were recruited as cases in the study after confirmation of their symptoms through history and physical examination.

Following children were excluded from the cases if any of the following conditions were present in any child:

- Those who were cases but were diagnosed with intestinal diseases, irritable bowel syndrome, food intolerance and medication reaction.
- Children with second and third degree malnutrition (according to modified Gomez Classification).
- Children who were seriously ill, dehydrated or shifted to Intensive care unit.
- Children with any eating disorders or psychological or psychiatric morbidity.

Data was collected through structured questionnaire comprising of semi closed questions from mothers. Two research assistants (medical officers of the same hospital) were trained about the data collection procedure. SPSS version 22 was used for data entry and analysis. A *p*-value <0.05 was considered as statistically significant. Stratified chi square test was applied to compare the association of various risk factors with acute diarrhea after stratification based on the educational status of mothers.

Permission from the participants was taken after explaining the purpose and benefit of the study and participation in the study was totally voluntary. The study was approved by the ASRB Khyber Medical University Peshawar. Also, permission from the Hospital's Commandant was obtained before conducting the study.

RESULTS

Amongst 363 children, 223 (61.4%) were males and 140 (38.6%) were females. The ages of children ranged from 2 to 5 years and amongst 363 children 94 (25.9%) were of 2 years of age, 92 (25.3%) were of 3 years, 68 (18.7%) of 4 years and 109 (30%) were of 5 years of age. 186 (51.2%) children were within age group 2-3 years while 177 (48.8%) belonged to age group 4-5 years. Mean ± SD are shown in table-I. Highly statisti-cally significant associations were observed between diarrhea and hygiene conditions such as access to drinking water, type of toilet facility, bottle cleaning habits of mothers as well as hand washing practices of mothers and children as seen in table-II. Results showed that children living in households with improper toilet system (54.6% vs. 23%, *p*<0.01), or bottle cleansing practices (63.3% vs. 18.5% vs. 4.8%, *p*=0.01), were more likely to suffer from diarrhea. Surprisingly, when looking at the drinking source used 64.3% used filtered water for drinking purpose compared to 36.5% and 26.2% diarrheal cases that used tap and natural resources for drinking purpose respectively. Thus mothers who were

Table-I: Descriptive statistics of age of children.

Age of children	All 363 children	121 cases	242 healthy controls
Mean	3.52	2.40	3.09
Median	3.00	2.00	3.00
Mode	5.00	2.00	4.00
Std. Deviation	1.17	0.65	0.94

using water from filter were more prone to develop diarrhea and other diseases. As expected, highly statistically significant results were observed between regular child and mother hand washing practice and absence of diarrhea among children (*p*-value=0.01).

As is evident from the results of table-III, statistically significant association was observed between type of toilets, water sources, bottle washing routines of mothers and occurrence of diarrhea in educated mothers' group only.

The proportion of the children with diarrhea was markedly higher in families with pit and open system of lavatory compared to those having flush systems (59.8% vs 22%). The proportion of the children with diarrhea was highest in filtered water supply compared to tap water and natural supplies (61.5% vs. 36.9% vs 20% respectively). None of the children of mothers, washing bottles with water, soap and sterilizers had any diarrhea and proportion was again lesser in those washing bottles with soap while highest proportion of children with diarrhea was observed in children whose mothers washed bottles only with water (17.5% vs. 64.8%).

However regarding the hand washing habits of mothers and children, highly statistically significant association was observed between hand washing habits of mothers and children and diarrhea, in both educated and uneducated mothers (p<0.01). The proportion of the children with diarrhea was markedly higher in mothers of children who did not or sometimes washed hands before feeding compared to those who always washed hands in both groups.

Table-II: Association of hygienic practices and diarrhea.

	Drinking Water	Diarrhea		Total (%)	(Chi-Square) *p*-value
		Present (%)	Absent (%)		
1	Tap	73 (36.5)	127 (63.5)	200 (100)	10.37 0.01**
	Filter	9 (64.3)	5 (35.7)	14 (100)	
	Natural sources	39 (26.2)	110 (73.8)	149 (100)	
	Total	121 (33.3)	242 (66.7)	363 (100)	
2	**Lavatory system**				
	Lavatory pit & open	65 (54.6)	54 (45.4)	119 (100)	36.10 0.01**
	Flush	56 (23)	188 (77)	177 (100)	
	Total	121 (33.3)	242 (66.7)	363 (100)	
3	**Bottle cleaning**				
	With soap and sterilization	3 (4.8)	59 (95.2)	62 (100)	94.85 0.01**
	With soap	30 (18.5)	132 (81.5)	162 (100)	
	With water only	88 (63.3)	51 (36.7)	139 (100)	
	Total	121 (33.3)	242 (66.7)	363 (100)	
4	**Child's hand washing**				
	Yes	20 (11.8)	149 (88.2)	169 (100)	71.64 0.01**
	No	1 (12.5)	7 (87.5)	8 (100)	
	Sometimes	100 (53.8)	86 (46.2)	186 (100)	
	Total	121 (33.3)	242 (66.7)	363 (100)	
5	**Mother's hand washing**				
	Yes	20 (15.3)	111 (84.7)	131 (100)	110.91 0.01**
	No	52 (92.9)	4 (7.1)	56 (100)	
	Sometimes	49 (27.8)	127 (72.2)	176 (100)	
	Total	121 (33.3)	242 (66.7)	363 (100)	

DISCUSSION

Our study indicates that the risk of having diarrhea is increased in children whose mothers have poor hygienic practices. Source of drinking water and type of lavatory was also strongly associated with childhood diarrhea.

Our finding on diarrhea prevalence is consistent with other studies in developing countries such as Bangladesh[14] Vietnam[15] and Nigeria[16] confirming that children with poor sanitary and hygiene conditions are more prone to develop diarrhea. However a study aimed at assessing the contribution of food-hygiene practice to the prevalence of diarrhea among Indonesian children was not significantly associated with diarrhea in the total group, but it was in children aged <2 years (adjusted OR 4.55, 95% CI=1.08-19.1)[17].

Table-III: Comparison of associations in educated and uneducated mothers.

	Educational status of mother		Diarrhea		Total	(χ-Statistic *p*-value)
			Present (%)	Absent (%)		
Toilet system	No formal education	Flush	10 (28.60)	25 (71.40)	35 (100)	0.5 0.48
		Pit & Open	10 (37.00)	17 (63.00)	27 (100)	
		Total	20 (32.30)	42 (67.70)	62 (100)	
	Received formal education	Flush	46 (22.00)	163 (78.00)	209 (100)	40.88 0.01**
		Pit & Open	55 (59.80)	37 (40.20)	92 (100)	
		Total	101 (33.60)	200 (64)	301 (100)	
Water source	No formal education	Tap	8 (33.30)	16 (66.70)	24 (100)	2.22 0.32
		Filtered	1 (100)	0 (0)	1 (100)	
		Natural Sources	11 (29.70)	26 (70.30)	37 (100)	
		Total	20 (32.30)	42 (67.70)	62 (100)	
	Received formal education	Tap	65 (36.90)	111 (63.10)	176 (100)	9.14 0.01**
		Filtered	8 (61.50)	5 (38.50)	13 (100)	
		Natural Sources	28 (25.00)	84 (75.00)	112 (100)	
		Total	101 (33.60)	200 (66.40)	301 (100)	
Mother's hand washing	No formal education	Wash	0 (0)	15 (100.00)	15 (100)	12.56 0.01**
		Donot Wash	5 (71.40)	2 (28.60)	7 (100)	
		Sometimes Wash	15 (37.50)	25 (62.50)	40 (100)	
		Total	20 (32.30)	42 (67.70)	62 (100)	
	Received formal education	Wash	20 (17.20)	96 (82.80)	116 (100)	103.78 0.01**
		Donot Wash	47 (95.90)	2 (4.10)	49 (100)	
		Sometimes Wash	34 (25.00)	102 (75.00)	136 (100)	
		Total	101 (33.60)	200 (66.40)	301 (100)	
Bottle cleaning	No formal education	Wash with soap & Sterilize	3 (33.30)	6 (66.70)	9 (100)	2.22 0.32
		Wash with soap	8 (22.20)	28 (77.80)	36 (100)	
		Wash with Water	9 (52.90)	8 (47.10)	17 (100)	
		Total	20 (32.30)	42 (67.70)	62 (100)	
	Received formal education	Wash with soap & Sterilize	0 (0)	53 (100)	53(100)	9.14 0.01**
		Wash with soap	22 (17.50)	104 (82.50)	126 (100)	
		Wash with Water	79 (64.80)	43 (35.20)	122 (100)	
		Total	101 (33.60)	200 (66.40)	301 (100)	
Child's hand washing	No formal education	Wash	0 (0)	19 (100.00)	19 (100)	13.05 0.01**
		Donot Wash	1 (50.00)	1 (50.00)	2 (100)	
		Sometimes Wash	19 (46.30)	22 (53.70)	41 (100)	
		Total	20 (32.30)	42 (67.70)	62 (100)	
	Received formal education	Wash	20 (13.30)	130 (86.70)	150 (100)	62.9 0.01**
		Donot Wash	0 (0)	6 (100)	6 (100)	
		Sometimes Wash	81 (55.90)	64 (44.10)	145 (100)	
		Total	101 (33.60)	200 (66.40)	301 (100)	

N.B. *p*-values are from chi-square tests.

Prior literature identifies poor water quality and toilet facilities as critical risk factors pre-

disposing under-five children to diarrhea[18]. A report by the World Bank (2010), investigating WASH and children's health based on surveys from 70 countries, indicate that children in households with access to a flush toilet show 17% lower odds for diarrhea than those using open defecation. This World Bank report, in addition to three reviewed meta-studies, found that improved sanitation has a some what higher positive effect on diarrhea than water infrastructure[19]. Therefore, the evidence supports that more resources should be invested in improving sanitation from basic or no sanitation technologies to advanced sanitation technologies.

There is evidence suggesting that public-sector water filtration plants, which are considered a main source of safe drinking water for the general public in many parts of the country, are providing contaminated water in the twin cities of Islamabad and Rawalpindi, because of the poor operation and maintenance of these facilities. According to their study the filtration plants in Peshawar also require replacement of cartridges with new filters (Filtration Plants - Threat to Citizens' Health (as of 27 June 2016) Alhasan Systems, relief web). This might be the reason behind the high prevalence of diarrheal children in filtered water supply compared to tap water and natural supplies in our study[20].

In our study the hand-washing practice of mothers was also associated with a lower risk of diarrhea among children. In a case-control study, the prevalence of diarrhea among children was significantly higher in those families where mothers less often washed their hands before feeding children[15]. Another updated review of the evidence linking interventions of the promotion of hand hygiene and diarrhea morbidity[21] showed a 40% reduction in diarrhea (RR 0.60, 95% CI 0.53–0.68). Indeed, the best studied hygiene practice with consistent evidence in developing countries is hand washing[22]. A cluster randomized controlled study of 36 low-income households in urban squatter settlements in Karachi, showed that enhancement in hand washing in the household reduced the incidence of diarrhea among children at high risk of death from diarrhea[23]. Regarding the childhood practice of hand washing, a recent review by Willmott and colleagues had summarized evidence on the effectiveness of hand hygiene interventions in reducing infectious illness for children aged three to eleven years and/or staff working with them, and obtained a quantified estimate of the effect[24].

Bottle feeding is quite common in child weaning age and thus was included in hygiene practices among mothers. In a study conducted by Agistina *et al* cleanliness of bottled milk were related to the source of food-borne transmission but did not show statistically significant associations with diarrhea[16]. Whereas, in our study highly statistically significant association was observed among bottle feeding practices and diarrhea among children.

Since the incidence of childhood diarrhea is more common in uneducated mothers according to some studies[11] we further stratified maternal education to get a comparison of hygiene practices among educated and uneducated mothers. This comparison has also been observed in a study at Ethiopia regarding toilet facility only. The type of toilet facility was stratified by maternal education and revealed that it varied with the level of education of mothers on childhood diarrhea. In the absence of toilet facility, children from mothers who had no education had a very high risk of developing diarrhea [OR: 9.16, 95% CI (5.79, 14.48)] than children from mothers who had primary and above education [OR: 3.73, 95% CI (2.03, 6.83)]. Therefore there was an interaction between toilet facility and maternal education as found in our study[25].

Out of all the variables in our study, hand washing practices in mothers and children were the only two, which had strong association in both the educated and the uneducated group of mothers.

CONCLUSION

Lack of hygiene practices among mothers especially the uneducated group is a major risk factor for diarrhea in children among CMH

Peshawar. Health awareness programs and developing resources for improved sanitation are the main methods to reduce this burden.

LIMITATION OF STUDY

This study has certain limitations. Firstly the hygiene practices were graded on the basis of self-reported behaviors of the mothers and hence are subject to inaccuracy and socially desirable answers. Therefore further investigation is required which should use household observations. Secondly the method of hand washing was also not described which showed a significant relation with absence of diarrhea in both educated and uneducated groups

RECOMMENDATION

Future projects should include a profound hygiene education of the local population along with improved household toilet and sanitary facilities in order to maximize the impact on children's health. Since behavioral choices are made in childhood, hygiene education should be introduced early in children because their poor hygiene habits are less established, unlike adults, whose habits are firmly grounded and difficult to change. However, more scientifically sound, evidence-based studies need to be carried out in developing countries; Since few studies have been performed, it is difficult to generalize the findings.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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