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Women, Water and Childhood Diarrhoea: Case Study of an Egyptian Village

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Women, Water and Childhood Diarrhea : Case Study of an Egyptian Village

By

* Shafika S. Nasser,
* Zeinab E.M. Afifi
and Amr S.Soliman

* Department of Community Medicine,
Faculty of Medicine, Cairo University

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Abstract :-

The situation of domestic water supply in Kombera village, the microbiological contamination of water, and its role in causing diarrhea were investigated in the period between 1985 and 1986. Data analysis showed that most of the women drew subsoil water by hand pumps and stored it in different containers for subsequent use. Most of the stored water was markedly contaminated especially that obtained from outdoor sources ($P < .01$).

The gross contamination of water was reported to the local governmental health authorities and discussed with the village women. The need for change was urgent. Accordingly, a new water system (deep well) was introduced in 1986. By now it satisfies most of the needs of the village for drinking water.

Introduction :-

When the united nations declared the period 1980-1990 as the international drinking water and sanitation decade, it was hoped that people will have access to safe potable water by 1990. The provision of adequate and safe water is a necessity of healthful living and wellbeing of individuals. It saves women's time (Cairn-Coss and Cliff, 1987) and enables them to devote more time to food preparation, with consequent nutritional benefits to their children (Tomkins et al., 1978).

In rural Egypt, most people consume insufficient quantities of poor quality water. The average daily share of water is only one tenth the amount estimated to be adequate i.e. 80-120 Litre per capita per day (El-Gamal , 1981). Few houses are provided with sanitary facilities that allow the use of running water. Water storage with its associated risks is practiced in almost all houses.

The incidence of diarrhea is high in Egypt. After four years of its operation the National Control of Diarrheal Disease Project (NCDDP) reported a decline in overall and diarrhea-specific infant and childhood mortality (El-Rafie et al., 1990). No similar decline was observed in the incidence of diarrhea. Improvements in water supply and sanitation seem to be more effective in preventing diarrhea. Since water interventions reduced diarrhea incidence by about 30% in different areas of the world(Esrey et al., 1985), this study was carried out to provide evidence to policy makers of the need for change. It had the following objectives :-

1. To assess the quality of water used for drinking, and in the preparation of childern's food in an Egyptian village.
2. To identify the possible sources of contamination.
3. To investigate the role of contaminated water and defective sanitation (Latrines) in inducing diarrhea among children under the age of three.
4. To initiate a movement to improve safe water supply to the village.

The Study Site :-

Kombera village is one of the villages of El-Guiza governorate. It has an area of about 2km². It lies about 45 km. South to Cairo. In 1985 its population was 3302; crude BR was 68.4‰ and IMR was 66.4‰. Most men are farmers; most women are house-wives. Sanitary conditions in the village are grossly defective. The most common source of water which is surface indoor or outdoor wells is improperly constructed.Schools, mosques and some general taps

receive deep well water from a nearby Government water project in Kafr Hakim. No organized service is available for collection or disposal of human and animal excreta. Manure heaps, fecal matter and garbage are scattered everywhere.

Accross the village is the El-Mariotia drainage canal where the sewage system of schools and mosques pours and village waste water, refuse, bird and animal carcases are disposed off. The presence of this canal provides an excellent breeding place for mosquitoes. It infiltrates the ground and contaminates the subsoil water which is used for drinking. The following hypotheses were set to be tested :

H_1: Subsoil water drained by hand pump in kombera village is contaminated (nearby latrines, refuse and dung heaps, mariotia canal).

H_2: Children consuming such water are at high risk of developing diarrhea.

Material and Methods :-

A case control study was carried out in kombera village in the period between the 15th of August 1984 and the 15th of February 1985. Ninety cases and 73 controls were selected from children aged three years or less while attending the village health center. The Criteria for caseness were a complaint of diarrhea together with a negative history of antibiotic intake. Controls were selected from healthy companions or patients complaining of diseases other than diarrhea.

The mother or care taker was interviewed at the village health center. Data were collected concerning the

socioeconomic and household characterestics; Sources of water and water use practices; the availability of latrine and history of present diarrhea attack.

Home visits were made on the same day to inspect the home environment and to collect water samples (500 ml). Water smaples were collected from water stored inside the house and used for drinking and or the preparation of baby food. The water samples were collected in sterile bottles and transfered immediately to M.O.H. Central laboratories. They were analysed microbiologically for lactose fermenters, non lactose fermenters and parasites. Standard M.O.H. analysis procedures were used.

Results :-

Table 1 shows the socioeconmic and household characterestics of cases and controls. The only significant difference was observed in the percentage of sibling deaths attributable to gastroenteritis. It was 22.2% in cases and 10.9% in controls ($P < .05$). Indoor Latrines existed in 83.3% of cases and 95.9% of controls (Table 2). The observed difference was statistically significant ($P < .05$).

Table 3 shows the soruce of water in the house_holds of cases and controls. Pump outside the house was the source in 40% of cases and 54.8% of controls. In 32.3% of cases and 24.7% of controls the source of water was from a pump inside the house.

Considering water storage practices (Table 4), the zeer was used in 72.2% of cases and 89.0% of controls. Covered and uncovered pots were used in 20.0% of cases and 5.5%

of controls. There was a statistical significant difference between storage of water in zeer and pot (covered or uncovered).

Table 5 shows that only 3.3% of water samples collected from houses in the cases and 2.7% of water smaples collected from control houses were negative. E.coli alone or in conjunction with klebsiella and/or citrobacter were found in 73.4% of case smaples and 63% of control water samples. The observed difference was statistically significant. E.coli was present in stored water of 58.4% of those who used itnernal tap, 61.5% of those who used general tap, 73.7% of those who used pump outside the house, 66% of those who used water derived from pump inside the house (Table 6). The largest number of samples containing E.coli was from stored water taken from pump outside the household. The observed difference of E.coli content in stored water according to the source of water was not statistically significant.

E.coli alone or with other organisms was present in 73.3% of water in zeer, in 72.7% of water in pots and in 63.6% of samples from houses with no storage (Table 7). No E.coli was present in 26.6% of samples from zeer, in 27.3% of pot samples and in 36.4% of water from houses with no storage. The observed difference between cases and controls according to E.coli content and type of water sotrage was not statistically significant.

Table 8 shows the distribution of controls according to source of water and level of coliform content in stored water. Eighty percent of water samples with high contamination

was obtained from out-door sources and 20% from indoor sources. On the other hand low contamination was encountered in 46.8% of out-door sources and 53.2% of indoor sources. There was a statistically significant difference between out-door and indoor sources of water concerning the level of contamination, if in both cases the water was stored inside the house.

Table (1): Socioeconomic and household characterestics of cases and controls

Comparison item	Cases	Controls	Significance
1- Mother			
- age	28.1±7.7	29.6±9.0	insig
- education(%illiterate)	100%	100%	//
- occupation(%housewife)	98.9%	100%	//
2- Father			
- age	35.1±9.0	34.3±8.3	//
- education(%illiterate)	96.7%	100%	//
- occupation(%labourer)	86.7%	91.8%	//
3- Family size	10.3±5.2	10.5±6.0	//
4- No.Living siblings	2.1±1.7	2.1±1.4	//
5- No. dead siblings	0.8±1.2	0.7±1.0	//
6- % sibling death due to gastroenteritis	22.2%	10.9%	P<0.05

* Expressed as mean±standard deviation or percentage

Table (2): Distribution of cases and controls according to the presence of latrine in the house

Presence	Cases		Controls	
	No.	%	No.	%
Yes	75	83.3	70	95.9
No	15	16.7	3	4.1
Total	90	100	73	100

$X^2 = 5.254$ df=1 p=0.021

Table (3): Comparison between cases and controls according to source of water

Sourc of water	Case		Control	
	No.	%	No.	%
Internal tap	12	13.3	12	16.4
General tap	11	12.2	2	2.7
Pump out_side	36	40.0	40	54.8
Pump inside	29	32.3	18	24.7
Others*	2	2.2	1	1.4
Total	90	100	73	100

* Others = more than one source

$X^2 = 10.355$ df = 5 P = 0.065

Table (4): Distribution of cases and controls according to containers used in storing water

Type of storage	Cases		Control	
	No.	%	No.	%
Zeer	65	72.2	65	89.0
Pot(covered and uncovered	18	20.0	4	5.5
No storage	7	7.8	4	5.5
Total	90	100	73	100

$X^2 = 7.67$ df = 1 P = 0.009

Table (5): Distribution of cases and controls according to lactose fermenters in stored water

Organism	Cases		Controls	
	No.	%	No.	%
Negative	3	3.3	2	2.7
E. Coli	9	10.0	18	24.7
Citrobacter	7	7.8	1	1.4
Klebsiella	6	6.6	14	19.2
E.Coli + Klebsiella	27	30.0	12	16.4
E.Coli + Citrabacter	14	15.6	10	13.7
Klebsiella + Citrobacter	8	8.9	11	15.1
E.coli + klebsiella + Citrobacter	16	17.8	5	6.8
Total	90	100	73	100

$X^2 = 22.038$ df = 7 P = 0.0025

Table (6): Distribution of cases and controls according to presence or absence of E. coli in stored water obtained from various sources

E.coli in stored water	Internal tap		General tap		Pump outside		Pump inside		Others	
	No.	%	No.	%	No.	%	No.	%	No.	%
E. coli ± other organisms	14	58.4	8	61.5	56	73.7	31	66	2	66.0
No E. coli	10	41.6	5	38.5	20	26.3	16	34	1	33.3
Total	24	100	13	100	76	100	47	100	3	100

$X^2 = 3.06$ df = 4 P = 0.5

Table (7): Distribution of cases and controls according to type of water storage and the presence of E. Coli in water.

Type of Storage / E.Coli content	Zeer		Pot (covered & uncovered)		No storage	
	No.	%	No.	%	No.	%
E.Coli ± other organisms	38	73.3	16	72.7	7	63.6
No E.Coli	42	26.6	6	27.3	4	36.4
Total	30	100	22	100	11	100

$X^2 = 0.018$ df = 2 p = 0.88

Table (8): Distribution of controls occording to source of water and level of water contamination.

Source of water	High contamination		Low contamination	
	No.	%	No.	%
Out-door source	20	80	22	46.8
In-door source	5	20	25	53.2
Total	25	100	47	100

$X^2 = 7.5$ df = 1 P = 0.01

* Low contamination : ⩽ 100 coliform/100 ml. water

High contamination: > 100 coliform/100 ml. water

Discussion :-

1) Socioeconomic and Household Characterestics :-

Both cases and controls came from poor, large, composite families. The only significant difference between the 2 groups was the percentage of sibling death attributable to gastroenteritis. It was responsible for 22.2% and 10.9% of deaths in siblings of cases and controls respectively. This difference was statistically significant ($P < 0.05$), indicating persistent factors leading to the occurrence of diarrhoea. These factors could be related to inadequate household conditions and hygienic practices within the family, favouring the transmission of diarrhoea. It could also denote women's practices and abilities in caring for their families and children.

2) Water and Sanitation in the Household :-

The presence of a pump outside or inside the house was the commonest source of water in the village. It represented 72.3% of cases and 79.5% of controls. There was no statistical difference between cases and controls($P > 0.05$).

The zeer (Fig. 1) was the most common container used for storing water in both cases (78.4%) and controls(94.3%). The observed difference was statistically significant ($P < 0.05$) implying that more controls than cases were storing their water in the zeer.

Water stored in the zeer may be less liable to contamination than that stored in pots, covered or uncovered. The former is mainly used for drinking, thus is subject to less manipulation. The level of the zeer being high, at least one meter off the ground, renders the water inside

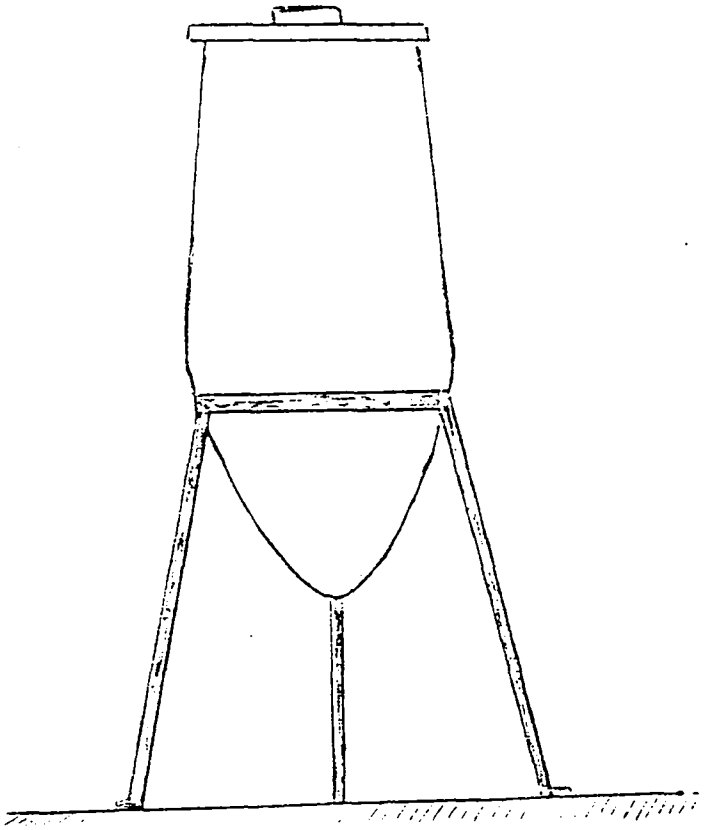

Figure 1 El Zeer

less liable to contamination by hands of children, small animals in the house and floor dust. The pot being used for drinking, cooking and washing is subject to excessive manipulation. In most instances, it is located directly on the floor. (Fig. 1).

Availability of latrines inside the houses are more common in controls (95.9%) than in cases (83.3%). The observed difference is statistically significant ($P < 0.05$). Water stored in house-holds with latrines had much lower risk of foecal cornamination than that stored in houses without latrines (O.R = 2.3).

The availability of a latrine in the house reduces the possibility of foecal contamination of household environment by promiscuous defecation. Hassouna in 1985 showed that larger proportion of children dying from diarrhea lived in houses without latrines (Hassouna, 1985).

Animals were present in the majority of house-holds of cses (71.1%) and controls (64.4%). There was no statistically significant difference between the two groups ($P > 0.05$).

3. **Water Examination** :-

Campylobacter was present in two samples of control water. Non agglutinable Vibrios (NAGs) were detected in one (1.1%) and two (2.8%) of samples of households of cases and controls respectively. Non lactose fermenters were present in 95.7% of household water of cases and 97.3% of

controls. E.coli alone or in conjunction with citrobacter and/or klebsiella were observed in 73% of cases and 61% of controls. The difference was statistically significant ($P < 0.05$).

Non lactose fermenters in water were detected in 72% of cases and 66% of controls. The most common observed non lactose fermenters were Proteus which was detected in 40% and 21.9% of samples from houses of cases and controls respectively. We see from this result that it was present in a significantly larger proportion of cases than controls ($P = 0.7$).

The major contamination of stored water by coliform bacilli could be explained by the following :-

1. In the majority of households of cases and controls (75%) the source of water was indoor pumps. Those pumps were dug at a depth ranging between 8-12 meters, thus had a high potential for contamination by nearby sources, these pumps also need priming which is usually done by unclean water, thus contaminating the underground water source itself.
2. Clean water collected from outdoor pumps (25%) is liable to contamination during its transport to the house.
3. Dipping of unclean hands and utensils into the containers increases the possibility of contamination particularly with prevailing unsound health behaviours. Women in the village believe that once water is obtained from a pipe it will remain pure regard-less of further modes of use (El Katsha and White, 1989).

No parasites were detected in water, possibly because protozoa do not multiply outside the living host (W.H.O. 1980 B). Ova and cysts are excreted in fewer numbers than bacteria and are easily retained by filtration through the earth, therefore are usually absent from pump water.

4. Water and Diarrhoea :-

Both quality and usage pattern of water are important factors in reducing diarrhoea morbidity. As reported by Black et al. (1982), provision of ample amounts of clean water at an accessible source would be very effective in reducing possibility of infection.

The results of the present study showed no significant association between type of the source of water and diarrhoea occurrence. i.e. cases and controls did not significantly differ by source.

Cases and controls did not also differ significantly in the presence of E.coli alone or with other organisms in their stored water E.coli were present in 73.4% of water used by cases and 61.7% of water used by controls($P > 0.05$). Though the difference is statistically insignificant, water used by cases had 1.7 times higher risk of being contaminated than that used by controls.

A further step in the analysis showed that most of the water samples were contaminated irrespective of the source. Although the source of contamination did not significantly differ by source, still the chance of contamination of water derived from internal tap is lower than that derived from general tap when both samples were stored in the

house (53.4% and 61.5% respectively). ALso the chance of contamination of water derived from indoor pump is lower than the chance of contamination of water derived from outdoor pump (73.7% and 66%). The risk of foecal contamination of water derived from outdoor pump is 1.4 time the risk of contamination of water derived from indoor pump. In short, indoor sources appear to be better than outdoor sources.

The most important observed difference between water derived from indoor and outdoor sources is in the level of foecal contamination encountered. Water derived from outdoor sources was significantly more contaminated than that derived from indoor source ($P < 0.01$).

Possible explanation of the high contamination of water derived from outdoor sources is the chance of contamination during transport, longer storage, more manipulation and exposure to contamination in the house.

A significant association was observed between the type of storage utensils and diarrhea occurrence ($P < 0.05$). In comparing storage utensils used by cases and controls, significantly larger proportion of controls were using zeer ($P < 0.05$). Significantly larger proportion of cases than controls were using pots (covered and uncovered 30.1 and 5.5% respectively). Storage was found to be associated with foecal contamination. The risk of contamination is higher if water is stored in pots (OR 1.6) and zeer (OR 1.5(than if no storage is practiced irrespective of the source.

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