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# RESEARCH ARTICLE

# BEHAVIOURAL FACTORS PREDISPOSING CHILDREN UNDER-FIVES TO DIARRHOEA IN DEVELOPING COUNTRIES; A CASE OF MIGORI COUNTY, KENYA

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## ABSTRACT

**Background:** Globally, diarrhoea disease is a major cause of morbidity among children under 5 years (under-fives). In Africa, there are 696 million cases of diarrhoea among under-fives every year. Diarrhoea accounted for about 4.7% of outpatient visits among under-fives in Kenya, a common observation in many developing countries. It appears that even with the well drummed up public health and maternal health programs among the developing countries, diarrheal infections continue to be a major challenge in the lives of children under five years. The object of this study was to examine the behavioral determinants of diarrhoea morbidity among children under 5 years. This was driven by observation of the challenges posed by diarrheal infections in the lives of young children in Migori county in Kenya. Study design involved a descriptive study where a questionnaire was used as the research instrument for data collection. A sample of 216 respondents was studied. **Results:** According to results, the behavioral factors associated with under five diarrhoea included hand washing with soap ($p<0.001$; food storage method ($p<0.001$); and heating stored food before feeding ($p<0.001$). Hand washing is important because it prevents transmission of infectious agents of diarrhoea after being in contact with excreta such as after changing babies' nappies. In addition, leftover food can act as a breeding ground for bacteria since the food has been in contact with saliva and skin. There is a need for interventions that promote appropriate practices in food storage method and emphasize heating storage foods. In conclusion, the study emphasizes that hygiene practices should be encouraged, and intervention programmes should be implemented to create awareness on proper refuse and wastewater disposal.

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## INTRODUCTION

In Africa, there are over 696 million cases of diarrhoea among under-fives every year. Moreover, about 46% deaths among under-fives in Africa are attributed to diarrhoea (M. Niefert and M. Bunik, 2013). Although diarrhoea is preventable and curable, the number of deaths among under-fives due to diarrhoea only reduced by four percent in Africa between 2000 and 2015 which can be due to high poverty levels and inadequate interventions. Behavioural factors such as child feeding practices, personal hygiene practices, seeking appropriate treatment measures and measles vaccination can influence diarrhoea occurrence amongst children of under-five years (S. Masiha *et al.*, 2015). However, in Migori County, about 75% of under-fives with diarrhoea do not receive recommended treatment and over 14% of under-fives do not receive measles vaccination which an increase the risk of the disease (GOK, 2013). Under-fives are also more vulnerable to dehydration from diarrhoea because of a high metabolic rate, high body water content, along with a high body surface area to mass index which contribute to increased turnover of solute and fluids (A. Koyfman, 2015). About 15% of under-fives have diarrhoea in Migori County every year (GOK, 2011).Diarrhoea cases, deaths & disease burden among under-fives can be reduced; however, interaction with predisposing factors is still high in Migori County. For example, about 75% of under-fives with diarrhoea do not receive recommended treatment and 14% of under-fives have not received measles vaccination (GOK, 2013). A considerable size of the population in Migori County (26%) resorts to open defecation due to lack of sanitation facilities. Although diarrhoea is a topical issue in many studies, our understanding of the main determinants responsible for diarrhoea morbidity among under-fives and the scale of the problem in Migori County (Kenya) remains limited. Besides, there is no published report on Migori County and many counties in Kenya about factors

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influencing diarrhoea occurrence among under-fives. In this regard, the current study intended to fill in the gaps so far identified. The main purpose of the study was to examine the behavioral factors that predispose children under 5 years to diarrhoea in Migori County. The study would be beneficial since programme development can become more effective given that the predisposing factors are identified and can be used to influence the development of appropriate intervention strategies that are specific to the study area and improve child survival. Consequently, the main objective of this study was to determine the behavioral factors that are associated with diarrhoea among children under 5 years in Migori County. Making changes in the behavior of the caregivers and mothers in the community can help stop the occurrence of diarrheal infections. This can only happen if the community is assisted in identifying and understanding those behaviors that predispose their children to diarrheal infections. Annual mortality in under-fives from diarrhoea in developing countries stand at 1.8 million deaths in 2015 which is a reduction from 4.5 million deaths in developing countries two decades ago (R. Gary, M. Fleisher, and D. Matson, 2013). Annual diarrhoea incidence in under-fives in developing countries includes 3.2 episodes. Gender and diarrhoea incidence show about 1.2 male to female ratio. There are various enteropathogens identified, including virus, bacteria, and pathogens. In developing countries, seasonality contributes to diarrhoea episodes since the viral diarrhoea peak in cooler months while bacterial diarrhoea peak in the hotter monthsago (R. Gary, M. Fleisher, and D. Matson, 2013).

All pathogens known to cause diarrhoea are transmitted mainly through the faecal-oral route either directly or indirectly (J. Jadhav, 2011). Direct transmission takes place through person-to-person contact or direct contact with the faecal matter (hand-to-mouth) (A.K. Mukherjee *et al*, 2010). Indirect transmission can be vector-borne (insects) or vehicle-borne (contaminated water, food, and objects).Vehicle-borne transmission occurs when an individual drinks water contaminated by faeces due to contamination of water sources or/and water storage facilities(A.K. Mukherjee *et al*, 2010). An individual may eat food contaminated by faeces due to poor hygiene or there can be contact with contaminated objects. Vector-borne transmission occurs when flies contaminate the utensils and food or land on under-fives directly. Faecal-oral transmission web is presented in Figure 1 below.

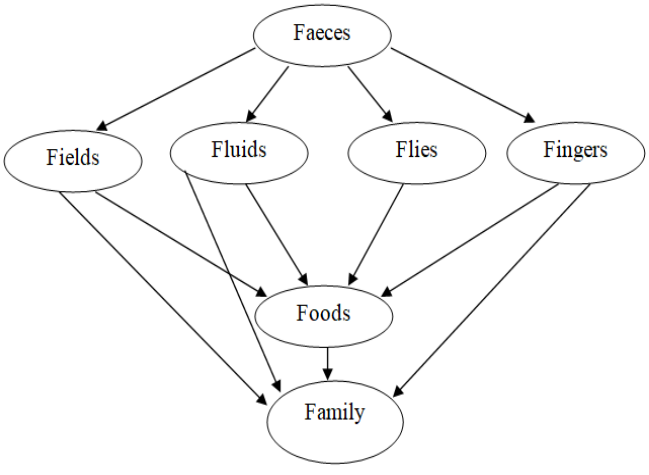


**Figure 1. Cycle of faecal-oral transmission (F-diagram); Source: Kumar and Vollmer (2012)**

Figure 1 shows the inter-relationship between the source/cause of diarrheal infections, the transmission, and the family environment. If the members of the family and especially the caregivers are not aware of the dangers and possibility of infection to the children, diarrheal infections keep affecting the children. The children under-five years of age cannot take full charge of the personal hygiene and hence are in danger of infections if not protected by a knowledgeable caregiver. Behavioural factors influence the exposure to infectious agents of diarrhoea disease (S. Ozdemir, N. Delialioğlu & G. Emeka, 2010). Personal hygiene practices, for instance dirty utensils and dirty kitchens may attract flies in houses which can spread diarrhoea infectious agents (MJ. Chisti *et al*, 2011). Not washing hands using soap after defecation before meals and before preparation of weaning foods is directly associated with increased diarrhoea among under-fives. Other risky behaviours for diarrhoea among under-fives include eating habits like eating cold leftovers, eating raw foods and contaminated fruits. Effective diarrhoea management relies mainly on early detection and treatment. Appropriate care plays a great role during diarrhoea episodes among under-fives since it can prevent mortality from diarrhoea by up to 30 % (L. Liu, S. Oza & RE. Black, 2012). Mothers who take their children for measles vaccination and rotavirus vaccination engage in important childcare practices since vaccination is vital for diarrhoea prevention. Immunization reduces diarrhoea by preventing infections causing diarrhoea (rotavirus) and infections (measles) that cause diarrhoea as a side effect (S. Karambu, 2013). Rotavirus causes 40% of diarrhoea hospital admissions among under-fives globally. Rotavirus is responsible for 100 million acute diarrhoea episodes annually and causes 350,000-600,000 diarrhoea deaths among children(L. Liu, S. Oza & RE. Black, 2012).

Undernourished children and those with suppressed immune system experience diarrhoea as a side effect of measles (HA. Woerdenbag *et al*, 2011). Death due to measles in under five occurs due to diarrhoea. Under-fives who are not vaccinated against measles and rotavirus suffer more diarrhoea mortality. Vitamin A supplementation is important in the prevention of diarrhoea and reduces mortality by 19-54% of children (L. Liu, S. Oza & RE. Black, 2012).Zinc intake and vitamin A supplementation also reduces complications, duration, and severity of diarrhoea. Hence mothers must ensure under-fives receive vitamin A supplementation. Breastfeeding has a direct role in the prevention of diarrhoea through protection of children under six months by delaying the contact of a child with contaminated weaning foods ((J. Jadhav, 2011). Moreover, exclusively breastfed infants tend to have lower diarrhoea episodes compared to non-breastfed infants(M. Niefert and M. Bunik, 2013).Breastfeeding also indirectly prevents diarrhoea by contributing to good nutrition, which boosts immunity. This is because breast milk has a higher concentration of antibodies which reduces diarrhoea risk (K. Gurpreet *et al*, 2011). Food preparation practices such as unsafe storage of weaning foods may affect diarrhoea morbidity among under-fives(JS. Nakawesi *et al*, 2010). Infants who are fed with dirty bottles have been found to be at more risk of diarrhoea compared to breastfed infants. However, these behavioral factors may be influenced by environmental factors, social economic factors, and cultural beliefs such as visiting traditional healers before getting appropriate medical intervention in health facilities (CS. Yilgwan & SN. Okolo, 2012).

Health service utilization influences childcare practices since the health facilities provide childcare practices such as immunization (MY. Yakoob *et al*, 2011). Health personnel also provide health education to mothers on exclusive breastfeeding, weaning practices, and relevant knowledge on early treatment of diarrhoea disease using modern methods like ORS. Moreover, ORS can be obtained from health facilities. Mothers who utilize health services are also given the knowledge on how to treat water for drinking and may even receive commodities for such treatment from the health facilities. During severe diarrhoea conditions such as dehydration, there is a need for medical attention in health facilities. One major reason why mortality related to diarrhoea disease is high is health service under-utilization. This implies that sick under-fives are not attended to by qualified, healthcare personnel until it is late. There are several factors that are responsible for health service under-utilization, such as unavailability of health facilities and mother's individual factors such as knowledge level on appropriate childcare practices.

## MATERIALS AND METHODS

The study area was Migori County in Kenya, which has an area of 2, 597 square kilometers (GOK, 2014). Population of Migori County is 1,038,712 people (MOH, 2013).About 15% of under-fives have diarrhoea in Migori County. Under five mortality rates in Migori County is 123 per 1000 live births. The rationale for selection of Migori County as the study location was that diarrhoea is a major cause of under-five morbidity in Migori County (GOK, 2013).Compared to other countries in Kenya, it is the leading in terms of diarrhoea occurrence among under-fives (GOK, 2015).The target population was all children under five years living in Migori County. The total population of under-fives in Migori County was 209,351 under fives. The study population included children under five years living in sampled Enumeration Areas (EAs) in Migori County (Kenya) was the unit of analysis, but their mothers (or caregivers) were interviewed on their behalf since they are minors who cannot answer for themselves.

**Inclusion and exclusion criteria:** Inclusion criteria: children under five years in selected households, whose mother (or caregiver) gave consent and voluntarily accepted to participate in the study. Exclusion criteria: children above five years living in Migori County; or the under-five meets the inclusion criteria but due to other compelling factors such as the mother (or caregiver) has serious communication problems or is unavailable or do not give consent, they were excluded

**Data collection and analysis:** Data was collection on the behavioral factors such as the childcare practices, which included hand washing, breastfeeding practices, weaning practices, vaccination and diarrhoea management. Data analysis was conducted using SPSS version 20 to generate descriptive statistics and inferential statistics to display the trend in the dataset and examine associations between diarrhoea and its determinants.

**Pre-test of questionnaire:** The questionnaire was pre-tested in Homa-Bay. Justification for undertaking the pre-test in Homa-Bay was that it is a neighbouring county with similar characteristics as Migori County with regard to the study variables. In addition, Homa-Bay County is second in terms of diarrhoea prevalence in Kenya. The reason for pre-testing was to identify any defects in the questionnaire such as ambiguity and question difficulty which were corrected (M. Sanders, P. Lewis & A. Thornhill, 2012). Pre-testing was done by administering the questionnaire to 10 mothers (or caregivers) of under-fives.

**Validity and Reliability:** Construct validity concerns ability of investigators to establish correct measures for concepts studied. This was achieved by using past surveys like 2008/09 KDHS to develop the study questionnaire (GOK, 2010). In addition, the incomplete and inconsistently filled questionnaires were not included in the analysis in this study to enhance validity. External validity concerns being able to generalize the result to the entire population. This was ensured in this study through random selection to achieve a representative sample. The study findings were also compared to the results of past studies.

Reliability refers to the extent to which a research instrument produces consistent and stable results. Reliability was ensured to minimize biases and errors in the study. Reliability of the instrument was accomplished by personally collecting the data using the same questionnaire for all samples to enable consistency of gathering information (GOK, 2010).

**Ethical and logistical considerations:** Ethical and logistical challenges that can be encountered during a research include issues of confidentiality, privacy, voluntariness and working with various institutional review boards (M. Sanders, P. Lewis & A. Thornhill, 2012). Strategies were developed in this study to address these challenges. To ensure confidentiality, the respondents in this study were treated with secrecy and privacy to protect them from victimization (B. Mathews & L. Ross, 2010). To ensure anonymity, the participants' names were not included in the report. Informed consent involved obtaining permission from a subject after giving an explanation that addresses a subject's concern. Informed consent was obtained from participants by explaining the risks and what to expect when involved before signing the consent form. In addition, ethical clearance was obtained from Kenyatta University Ethics Review Committee. Administrative approval involves getting official permission to conduct a research in an area. To attain administrative approval, research authorization and research clearance permit was sought from National Commission for Science, Technology, and Innovation.

## RESULTS

According to the results, 58.1% of mothers (or caregivers) of under-fives reported that they washed their hands, both before preparing food, and after visiting the toilet or wiping their children after toilet. In addition, 62.7% of under-fives aged between 6─59 months had received Vitamin A supplementation within the last 6 months before the survey and almost all (94.8%) of the eligible under-fives (aged between 9 to 59 months) had been vaccinated against measles by the time the study was being conducted. The results looked quite impressive so expected considering the caregivers/mothers where the ones answering the questions and there was no way to check the correctness of the responses. (This being a rural population they would like positive things written about them). The results indicated that 20.8% of under-fives were reportedly given food that had been stored in a plates or container without cover.

**Table 1. Distribution of behavioral characteristics by diarrhoea occurrence among under-fives, Migori County (N=210)**

| | *Diarrhoea occurrence* | | |
|---|---|---|---|
| | | | *Chi-square or Fischer's' exact test* |
| | *Diarrhoea* | *No diarrhoea* | |
| Hand washing with soap | | | |
| After visiting the toilet or wiping baby | 2(66.7%) | 1(33.3%) | $p$<.001 |
| Before preparing food | 8(66.7%) | 4(33.3%) | |
| Both | 14(11.5%) | 108(88.5%) | |
| Breastfeeding practice[1]* | | | |
| Exclusive | 1(9.1%) | 10(90.9%) | $p$ = .400 |
| Non-exclusive | 6(24.0%) | 19(76.0%) | |
| Supplementation and vaccination | | | |
| Vitamin A supplementation only | 1(25.0%) | 3(75.0%) | $p$ = .687 |
| Measles vaccination only | 7(15.6%) | 38(84.4%) | |
| Both | 18(17.8%) | 83(82.2%) | |
| Food preparation practices[1] † | | | |
| Food storage method | | | $x^2$ = 23.221 |
| Refrigerator | 1(6.3%) | 15(93.8%) | df = 2 |
| Covered container | 17(12.5%) | 119(87.5%) | $p$< .001 |
| Uncovered container | 18(45.0%) | 22(55.0%) | |
| Heating stored food[1] ‡ | | | $x^2$ = 85.008 |
| Heating | 11(6.9%) | 148(93.1%) | df = 1 |
| No heating | 25(75.8%) | 8(24.2%) | $p$< .001 |
| Feeding method[1] § | | | |
| Beverages | | | |
| Bottle feeding | 4(28.6%) | 10(71.4%) | $p$= .069 |
| Cup feeding | 2(33.3%) | 4(66.7%) | |
| Both | 2(33.3%) | 4(66.7%) | |
| Solid food | | | |
| Finger feeding | 9(19.6%) | 37(80.4%) | $x^2$ =0.142 |
| Spoon feeding | 1(14.3%) | 6(85.7%) | df = 2 |
| Both | 7(17.5%) | 33(82.5%) | $p$ = .142 |

Also, 17.2% of the mothers (or caregivers) of under-fives reported not heating stored food before feeding the children. Not all children in the study were on breast milk at the time of data collection, according to results, only 42.4% (89) of under-fives studied were on breast milk. In addition, only 5.28% (11) of under-fives were exclusively breastfed which translates into 28.9% (11) of under-fives aged 6 months and below (n = 38). According to the results, 42.1% (16) of under-fives aged 6 months and below (n = 38) fed or were fed using fingers while 26.3% (10) were bottle-fed. Table 1 presents the behavioral characteristics by diarrhoea occurrence among under-fives showing the effects of the various behavior among the children of under-five year of age. The handling of food, covering it or not covering, poor storage as almost all the homes have no refrigeration facilities and the fact that food was only heated/warmed to temperatures that would allow feeding therefor not enough to destroy the contaminating microbes.

Fischer exact tests showed that hand washing with soap was significantly associated with diarrhoea (□<0.001) occurrence. This means that those caregivers who did not wash their hands with soap were likely to contaminate the food or their children with diarrhoea causing microorganisms. In addition, Chi-square tests showed that the food storage method (□<0.001) and heating stored food ($p$<0.001) were significantly associated with diarrhoea. This means that food that was poorly stored uncovered and then not heated well before feeding the children had high chances of carrying diarrhoea causing microorganisms. The rest of the behavioral characteristics did not show a significant association with diarrhoea among under-fives. From the results its clearly seen that there is a relationship between poor hygiene behavior and diarrhoea occurrence in children as the poor hygiene practices or behavior predisposes the children to exposure to the diarrhoea causing microorganisms.

## DISCUSSION

Behavioural characteristics of mothers (or caregivers) of under-fives associated with diarrhoea among under-fives were also examined in this study. According to the results, lack of hand washing with soap was associated with the occurrence of diarrhoea among under-fives. This would explain the fact that even though the caregivers know they need to wash their hands to stop diarrhoea infections in children, the infections are still common as the caregivers do not use soap. This finding conforms to systemic reviews reporting that not washing hands is a risk factor for diarrhoea (MK. Munos, CL. Walker & RE. Black, 2010). Hand washing is important because it prevents transmission of infectious agents of diarrhoea after being in contact with excreta such as after changing babies' nappies as noted by a study in a rural community of Madhya Pradesh (M. Bhattacharya, V. Joon & V. Jaiswal, 2011).Some mothers (or caregivers) did not wash their hands with soap before preparing food, and after visiting the toilet or wiping the baby. Effective as the soap Washing hands particularly with soap appears to be is known to have effect on the cell membranes of the infectious microorganisms and destroys them. The results showed that children who were fed on unheated leftover food were more likely to experience diarrhoea compared to those who were fed on heated leftover foods. This finding concurs with that of a study in Bangladesh which reported that feeding children under-fivesyears old on cold leftover foods was a risk for contracting diarrhoea diseases (MJ. Chisti *et al*., 2011). In the area of study food was mainly stored in uncovered or poor covered container exposing the food to contamination through air or touch by other older children or adults.E. Kariptas, E. Çil & K. Isik, (2011) in a study carried in Turkey, noted that leftover food can act as a breeding ground for bacteria since the food has been in contact with saliva and skin.

If left uncovered, or if inadequately covered, the food can also be contaminated. When food is heated, the germs are killed under high temperatures. A. Shamshul et al, (2012) in study carried in Kathmandu, Nepal noted that diarrhoea disease can be prevented by heating the leftover food to high temperatures. There is need for mothers (or caregivers) of under-fives to practice heating stored food before feeding under-fives, especially when food is improperly stored to reduce the risk of diarrhoea among under-fives as the higher temperature denature the proteins in the cell membranes of the microorganisms destroying them. Part of the role of the community health workers working in the rural areas of the developing countries would include educating mothers (or caregivers) on the importance of properly heating leftover foods before feeding their children. Mothers (or caregivers) who reported using appropriate food storage methods for leftover food fed later to the children under five years were less likely to report diarrhoea among their children. These results are in conformity with those of a study in Nigeria ((CS. Yilgwan & SN. Okolo, 2012), which reported that exposure to causative agents of diarrhoea is frequently related to unhygienic practice of not covering stored food. A similar study in Uganda ((JS. Nakawesi *et al*, 2010) also reported that poor storage of food leads to contamination of food by flies. Poor food storage is common in many rural Kenya villages; this coupled with the fact that older children are left to care for the young children, food is further contaminated through poor handling by these young care givers. It follows then that the training in proper handling of food would need to be extended to the whole families/communities not just the mother considering that in this community the care for the young is a communal responsibility. Breastfeeding practice, measles vaccination and vitamin A supplementation, and feeding method were not associated with the occurrence of diarrhoea among under-fives. This agree with the expected results as most Kenya children of ages 0-5 years undergo vaccination and vitamin A supplementation in line with the requirement by the government and the world Health Organization (WHO). The findings contrast with those of a study in India, which reported that breastfeeding, Vitamin A supplementation and measles vaccination are associated with diarrhoea among under-fives in developing countries (S. Laishram, G. Kang & SS. Ajjampur, 2012).This could have been because most of the children in this study were vaccinated and a considerable number were exclusively breastfed. According to a study in Igembe District (Kenya) by (S. Karambu (2013), measles vaccination and vitamin A supplementation has been documented to reduce cases of diarrhoea since vaccination reduces diarrhoea by preventing infections (measles) that cause diarrhoea as a side effect and boosts immunity of under-fives. Moreover, exclusively breastfed infants tend to have lower diarrhoea episodes compared to non-breastfed infants as noted by a study in the US (M. Niefert and M. Bunik, 2013).It is important that children under six months should be exclusively breastfed since this delays the contact of a child with contaminated weaning foods. Indeed, a study in Bangalore, noted that breastfeeding has a direct role in the prevention of diarrhoea ((J. Jadhav, 2011). In addition, efforts to sustain the high vaccination coverage achieved in Migori County should be instituted. Food contamination can also occur through feeding method if there is use of dirty utensils and unwashed fingers, which can lead to diarrhoea morbidity as noted by an article on acute diarrhoea in children(R. Gary, M. Fleisher, and D. Matson, 2013).

**Conclusion and recommendation**

The behavioral factors that are predisposing children under 5 years to diarrhoea in Migori County were established in this study. In the study community, there is a need for preventive behaviour to be encouraged by providing health education to help people understand the link between hand washing and diarrhoea prevention and thus contribute towards reducing occurrence of diarrhoea illness in Migori County. This would need to be done across the rural Kenyan communities and other developing areas. Poor food storage method and heating stored food before feeding under-fives were found to be determinants of diarrhoea occurrence. The implication of this is that there is a need for interventions by Migori County that promote appropriate practices in food storage method such as creation of awareness on importance of storage of food trays or containers with covers to prevent contamination of food by flies and support reduction in diarrhoea diseases. These study results have vital practical and policy recommendations for combating diarrhoea among under-fives in Migori County. Hygiene and diarrhoea preventive practices, such as hand washing with soap, should be encouraged among all household members. Public Health officers through community sensitization, health campaigns, community mobilization and health education can implement this. Such interventions are important towards increasing their knowledge on the need for hand washing with soap and proper food preparation practices.

Future studies need to conduct investigations on barriers to diarrhoea management in developing countries as diarrhoea continues to affect the overall health of many children in those countries. Studies to establish the reasons for actual relationship between poverty levels and diarrhoea occurrence even with relatively improved public health conditions may need to be documented. This study used self-reported tools to collect information so there need to improve the data by for example interviewing different family members of a family simultaneously and compare their responses.

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