

Geophagia as a risk factor for diarrhoea

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Abstract

Background: Many children under the age of five are exposed to environmental health risks in the home environment. These lead to diseases such as diarrhoea, which along with acute respiratory infections, malaria and intestinal worms, account for 70% of the total health burden to children under five in Kenya. The aim of this study was to investigate whether earth eating within the home environment by children is a risk factor for diarrhoeal disease.

Methodology: A longitudinal study was conducted in 350 households having children aged below five years between April and October, 2005. Questionnaire and observation were used to collect data on participant demographics, earth eating practices in children, incidence of diarrhoea, structure of the home, sanitary facilities available, and presence of faecal matter in the yard.

Results: Thirty-seven percent of index children ingest earth occasionally (less than a handful) and 12% ingest a lot (a handful or more). Diarrhoea is positively correlated with earth eating ($r = 0.306$), presence of human faeces in the yard ($r = 0.587$), presence of animal faeces in the yard ($r = 0.225$) and the index child not wearing loincloth ($r = 0.471$). Chi-square test of independence also indicates that earth eating is significantly related to diarrhoea ($p < 0.005$).

Conclusion: Earth eating is a risk factor for diarrhoea in the home environment in this region of Kenya.

Key words: Children, diarrhoea, faeces, geophagia, risk

J Infect Developing Countries 2009; 3(2):94-98.

Received 29 April 2008 - Accepted 30 August 2008

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Introduction

Pica is an eating disorder typically defined as the persistent eating of non nutritive substances for a period of at least one month at an age in which the behavior is considered mentally inappropriate [1]. Geophagia (earth/clay/soil eating) is the most common form of pica in people who live in poverty [2, 3], in the tropics and in societies who adhere more to their traditions [4]. While it is believed by some that geophagia is a response to a physiological need and is related to growth periods such as pregnancy and childhood [5], in Africa, the habit is widespread and is passed from one generation to another because of cultural beliefs and genuine enjoyment of the habit rather than physiologic necessity [6].

Children who practice geophagia are prone to malnutrition, anemia, diarrhoea, constipation and worm infestation. Studies in Kenya [7] and Guinea [4] found a strong association between geophagia and prevalence and intensity of intestinal parasite infections. In a Jamaican study, children who practiced geophagia were prone to malnutrition, anaemia, diarrhoea and worm infestation [8]. Diarrhoea is defined as the passing of at least three

loose stools within 24 hours. Episodes are regarded as separate if there are at least two intervening days between the passage of loose stools [9].

Annually, diarrhoea accounts for the deaths of over 1.6 million children under the age of five or about 15% of all deaths of children under five in developing countries [10]. The average young child in the developing world, whether in Asia, sub-Saharan Africa, or Latin America, experiences four to five episodes of diarrhoea per year [11]. Diarrhoea is among the diseases of priority along with malaria, acute respiratory infections and intestinal worms in Kenya, as they account for 70% of the total health burden to children under five [12]. Despite the significant decrease in mortality figures from diarrhoea over the past two decades due to improvements in the treatment of dehydration, the number of deaths and the burden of disease are still unacceptably high [13].

The aim of this study was to establish whether geophagia in children within the home environment is a risk factor for diarrhoeal disease

Methodology

The people living in Mauche division are mainly squatters who have encroached on forest land. They are peasant farmers growing mainly maize, legumes, potatoes, and leafy vegetables on farm sizes that range from less than a hectare to five hectares. The population proportion in this area whose welfare falls below the poverty line is 0.57-0.65 [14]. The study area was selected because children from poor families are more vulnerable to diseases that are related to poor environmental conditions.

The longitudinal study was conducted in April to October 2005. With the help of village elders, households with children aged 1 to 4 years were noted. These children were referred to as the index children. Children in this age group within rural settings have not gone to school so they spend most of their time at home. They have learned how to crawl or walk so they are fairly independent and can move from place to place within the homestead. Based on two administrative blocks (referred to as locations) within the study region, Mauche and Nessuit locations, 175 households were randomly selected from each location giving a total of 350 households. A survey questionnaire and observation were used to collect data.

Local village girls who had attained at least 12 years of formal schooling were used as research assistants because they would be given more truthful responses than strangers. The girls were informed that their presence would influence behaviors so they were taught to be as discrete as possible in their observations. Techniques for probing and on-the-spot observations were included in the research training. To make training sessions more effective, observations were made at friends' and relatives' homes and the results compared.

A questionnaire administered to the mother/caretaker in each study household at the beginning of the study collected demographic data and established whether the child ate earth. Occasional earth ingestion was defined as eating less than a handful (child's) per day, while eating a large quantity of earth was defined as eating one handful or more of earth within a day. Observation was used to record structure of the home and sanitary facilities available as well as manner of disposal of children's faecal matter. To determine diarrhoea morbidity in index children, there were fortnightly short visits whereby the point prevalence of diarrhoea and its incidence over the preceding two weeks were measured by the mother's recall, as recommended in the World Health Organization (WHO) [15] rapid

assessment manual. Spot observations were also conducted during these visits to determine the presence of human and animal faecal matter in the yard and whether the index children were wearing loincloths or not. For each household, the research assistant made at least five visits.

Data was entered into a database using the Epi Info software package (version 3.3) and checked for entry errors. The data was then transferred to SPSS (Version 12.0) for analysis. Tables and graphs were used to organize and present the data. Proportions were used to estimate the diarrhoea episodes for both the index children who practiced geophagia and those who did not practice it. Pearson's correlation was used to establish whether the various parameters investigated were correlated. Chi-square's test for independence was used to test the hypothesis that geophagia and diarrhoea are not related.

Results

The average household size was six persons. The average number of children per household was four with some families having as many as 13. The average number of children aged below five per household was two. All except one household lived in houses with earthen floors. Results in table 1 indicate that a higher percentage of those who ingested a lot of earth had one or more diarrhoea episodes. Chi-square's test for independence calculated from table 1 indicates that earth eating is significantly related to diarrhoea ($p < 0.005$). The study was not conducted all year round, so there is a limitation in capturing seasonal differences in diarrhoeal diseases that may be related to geophagia.

Table 1. Diarrhoea episodes in index children in relation to earth eating.

	Earth eating		
	A lot	Occasionally	Never
Diarrhoea (at least one episode)	95% (n = 37)	76% (n = 99)	55% (n = 100)
No diarrhoea	5% (n = 2)	24% (n = 31)	45% (n = 81)
P value (0.05 significance level)	< 0.005	< 0.005	< 0.005

The percentage of children who never ingested any soil showed a gradual decline with increase in number of diarrhoea episodes (fig.1). For those with the highest number of diarrhoea episodes, the

category that ate a lot of earth stands out compared to those who ate occasionally, or never ate at all.

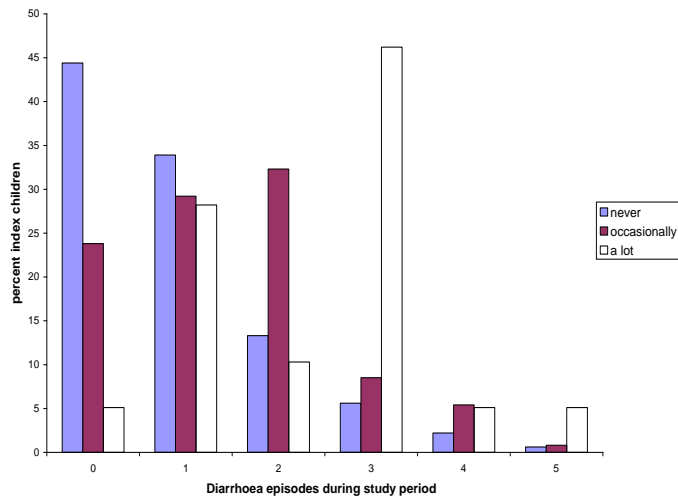


Figure 1. Diarrhoea episodes in relation to soil ingestion.

Table 2 shows the presence and type of latrine in households where children ingested earth either occasionally or a lot. The most popular type of latrine was a simple pit with a wooden floor. This consisted of a log placed over a pit with a hole drilled in the middle. A simple structure is then built over it to offer privacy. No latrine implies defecating in bushes found around the homestead for the adults and older children and on the yard and garden for younger children. Faecal matter for the younger children collected from yards was observed to be thrown in the gardens or bushes nearby.

Table 2. Presence and type of latrine in study households.

	Frequency	Percent
Ventilated Improved Pit (VIP) latrine	1	0.6
simple pit with cement floor	3	1.8
simple pit with wood floor	87	51.5
simple pit with earth floor	14	8.3
no latrine	64	37.9
Total	169	100.0

In 40% (n = 67) of households, human faeces were seen in the yard at least once, while in 74% (n = 125) animal faecal matter was present. The animal faecal matter was that of cattle and sheep. These faecal matters may contain pathogens that are likely to contaminate the soils in surrounding yards and play areas. Fifty-one percent (n = 86) of index

children were observed not to have any loincloth whenever visits were made to their homes.

At the 0.01 level, diarrhoea is positively correlated with earth eating (r = 0.306), presence of human faeces in the yard (r = 0.587), presence of animal faeces in the yard (r = 0.225) and the index child not wearing a loincloth (r=0.471). The index child not wearing loincloth is positively correlated to the presence of human faeces in the yard (r = 0.599). The presence of human faeces in the yard is positively correlated to the presence of animal faeces in the yard (r=0.328). At 0.05 confidence level, no latrine in the homestead is positively correlated to the presence of human faeces in the yard (r = 0.185). These correlations indicate that diarrhoea prevalence was higher in households where children ate earth, where human and animal faeces were seen to be present in the yard, and where the index child was not wearing a loincloth and was thus most likely to defecate indiscriminately, contaminating the play area. This may explain why not wearing a loincloth by the index child is positively correlated to the presence of human faeces in the yard. Absence of a latrine in the homestead discourages proper human faecal disposal. Additionally, we found that yards with human faecal matter present also have animal faeces.

Discussion

Children not wearing loincloths means that they are likely to defecate indiscriminately and their faecal matter is likely to lie anywhere in the yard for some time before it is noticed by the mother/caretaker or before it is eaten or dispersed by dogs and chickens. This situation could explain why the presence of faecal matter, especially that of children, is commonplace in the yards of many homesteads. Children’s excreta are more likely to contain diarrhoeal pathogens, but in almost every culture are regarded as less harmful than those of adults [16]. A study in Bangladesh revealed that most children younger than three years of age defecated in the house or courtyard and the faeces were usually swept or shoveled up and disposed of in the bushes or fields. Only 20% of households threw faeces in the latrine [17]. Faecal matter that contaminates the yards and playgrounds consequently gets into the gastrointestinal tract when children ingest earth from these grounds. Statistics from WHO [10] indicate that over 40% of the global burden of disease attributed to environmental factors falls on children below five years of age. At least 20 viral, bacterial,

and protozoan enteric pathogens, including *Salmonella spp.*, *Shigella spp.*, *Vibrio cholerae* and rotavirus have been identified in human faecal matter and they cause diarrhoea in new hosts [18].

Diarrhoea is positively correlated with earth eating ($r = 0.306$). Chi-square test of independence also indicates that earth eating is significantly related to diarrhoea ($p < 0.005$). Diarrhoea-related disorders are among the leading causes of death in young children because of the resulting malnutrition and poor immunity to infectious diseases. Kenya has a national chronic malnutrition (height for age) rate of 33%, which translates to one out of every three children being stunted [12]. Beyond these direct health effects, the thousands of cases of child diarrhoea have a significant impact on the way mothers spend their time on household expenses for treatment (medicines, transport and health facility charges), as well as on lost work, wages, and productivity by the working members of the household [19].

Children aged one to four years are more independent and are exploring their environment. The children move around more freely and, in most households, childcare practices were observed to be poor. Less attention is given to these children, since they are weaned off the breast and the mother may be expecting another baby or may already have one. Their earth ingestion practices may not be controlled adequately since the floors of almost all houses and yards are earthen. The Ministry of Health in Kenya developed an Environmental Sanitation and Hygiene Policy in 2007. This policy incorporated children by prioritizing their development as a human right [12]—consistent with reducing child morbidity and mortality, one of the Millennium Development Goals (MDGs). However, this policy concentrates on children's environmental health in school and institutional settings, excluding the preschool children in the home environment, who are more vulnerable.

Interventions that prevent faecal matter entering the domestic environment of the susceptible child are likely to be of great significance for public health. Proper sanitation has been documented to play an important role in preventing diarrhoeal diseases [20]. Apart from gastrointestinal infections, it prevents other conditions such as childhood asthma and trachoma, the second leading cause of blindness worldwide [21]. Achieving adequate sanitation in this study area is a challenge given that several households do not own latrines. This is also a

national challenge since the national sanitation coverage level of rural households in Kenya is 46.7% [12]. A latrine is normally installed on a family's private property and households may not always see one as a high priority.

Conclusion and Recommendation

Our findings indicate that geophagia is a risk factor for diarrhoea in the home environment in this region of Kenya, yet the Environmental Sanitation and Hygiene Policy in place in Kenya does not put much emphasis on children aged one to four, who spend most of their time within the home environment. Reduction of childhood morbidity and mortality is one of the hallmarks of poverty reduction, as outlined in the Kenya National Poverty Eradication Plan [22]. If this is to be achieved, there is need for concerted efforts towards promoting child environmental health in the home setting.

Acknowledgments

This study was supported by a grant from German Academic Exchange Service (DAAD).

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Conflict of interest: No conflict of interest is declared.