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Household Level Factors Associated with Practices towards Water, Sanitation and Hygiene with Occurrence of Diarrhea and Tungiasis among Pupils in Schools with a Feeding Programme in Ganze Sub County, Kenya

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Abstract

Background: Inadequate water sanitation and hygiene (WASH) can lead to a number of health problems, including stunted growth, diarrheal and tungiasis illness and even death. Most of the burden of diarrheal diseases and tungiasis infestation can be preventable with improvements in Household sanitation and water quality such as point of use disinfection. The Main objective of the study was to determine the household level factors associated with practices towards WASH on tungiasis and diarrhea occurrence among parents/ guardians of pupils in schools implementing Home Grown School Meals Programme (HGSMP).

Methods: A school-based cross-sectional study design was employed in which data from a control and intervention sites were compared. 24 schools (12 as control and 12 as intervention) were included. Guardians of the 240 pupils in the selected schools were also interviewed. Quantitative data was collected through a pretested structured questionnaire. The data was keyed-into the SPSS version 23 and analysed.

Results: Demographic characteristics e.g gender (χ^2= 7.979, df = 1, P<0.005), marital status (χ^2= 12.081, df = 5, P<0.005) and age (χ^2= 17.438, df = 7, P<0.005) revealed significance relationships. Further significance was noted between diseases associated with water (χ^2= 235.986, df = 3, P<0.005) and diarrhoea, Knowledge of diseases associated with WASH (χ^2= 108.519, df = 1, P<0.005), Participation in WASH programmes (χ^2= 2.339, df = 2, P<0.005), Condition of water containers for collection and storage (χ^2= 10.649, df = 2, P<0.005) and Preferred water treatment methods (χ^2= 11.978, df = 4, P<0.005) also revealed significance relationship with disease occurrence. Family members aged 5-15 yrs were 9.7% more likely to suffer from diarrhea, while ages above 15yrs were 4.4% less likely to suffer from diarrhea.

Conclusions: Household levels attributes like; Demographics, Knowledge levels, Participation in WASH activities, Water treatment and Storage are factors influencing practices towards WASH hence hindering prevention and control of diarrhea and tungiasis occurrence. Control programs need to adopt a more synergistic and comprehensive approach at the school and community levels. Health education at the two levels is also imperative to significantly reduce the spread and morbidity from diarrhea and tungiasis. From the study environmental, demographic and behavioral factors significantly predict disease occurrence.

Keywords: Practice, Tungiasis, Diarrhoea, Water, Sanitation, Hygiene, Household, Prevention, Control, Community, Ganze.

Background

Inadequate sanitation can lead to a number of health problems, including stunted growth, diarrheal and tungiasis illness and even death. Equitable access to household sanitation is of particular concern. Data is scarce, but recent estimates suggest that only 45% of schools and the catchment areas in low income countries have adequate sanitation facilities (Bartram & Cairncross, 2010).

School health and nutrition programmes (SHN), which include Homegrown School Meals (HGSM), are now widely recognized as significant contributors to the attainment of the Millennium Development Goals in regard to food security, Health and Education for All Homegrown School Meals (HGSM) programme generally aims at providing school meals to children in schools located in food insecure areas like Ganze. Such meals may act as an incentive and mechanism for increased child attendance and attainment in school. Its primary objective is to promote school attendance including gender parity while enhancing cognitive abilities. These effects are more effective when combined with other complementary actions such as water and sanitation programmes, deworming, providing food and/or micronutrients (Gakidou *et al.,* 2010). The burden of sanitation related illnesses like diarrhea and jiggers among school going children and their guardians is an important prerequisite for the development of both quick-win and long term solutions. This will help guide outreach programs and improve understanding of other correlates of early childhood development (Annette *et al.,* 2004).

Globally it is estimated that inadequate water sanitation and hygiene is responsible for 4% of all deaths and 5.7% of the of the total disease burden (Annette *et al.,* 2004). In Kenya, 17 million of the country's 40 million inhabitants do not have access to clean drinking water. The most official estimates of access from the Government of Kenya put water supply coverage at 42 percent and sanitation coverage at 31 percent in 2006 (urban and rural areas combined) (Water and Sanitation Programme, 2006). Most of the burden of diarrheal diseases and tungiasis infestation can be preventable with improvements in sanitation, water quality such as point of use disinfection. Proper sanitation infrastructure and behaviors at the household and school levels can improve attendance and improve educational outcomes, leading to societal impacts on human productivity and dignity. Activities at schools also model sanitation technologies and behaviors that are transferred from schools and school children to households and community. Similarly, School Feeding Programmes have been shown to impact positively on enrollment, nutritional status and cognition of school children as well as reduce hunger and improve poverty indicators (World Bank, 2012). The general objective for the study was to determine factors associated with occurrence of diarrhea and tungiasis among pupils in schools with and without HGSMP and specifically determine the level of knowledge, attitude and practices towards water, sanitation and hygiene among pupils and parents in schools with and without HGSMP in Ganze Sub County.

Methods

Study Area

The study was conducted in the 4 divisions of Ganze Sub County, Kilifi County, namely; Bamba, Ganze, Vitengeni and Jaribuni. The geographical coordinates are 3° 32' 0" South, 39° 41' 0" East. It is located on the North-West Coast of Kenya, and has semiarid vegetation with very little rainfall in the months of May and August. Ganze has a population of close to 140,000 Citizens and stretches on a 3,000 km^2 surface. It's classified among the poorest of areas in Kenya. It is estimated that more than 90%, 85% and 80% of the population living in Bamba, Ganze and Vitengeni Division live below the poverty line, respectively. Poverty in the area has made it hard for the majority of the people to access basic needs such as food, shelter, clothing, health, water and education. Factors influencing this include climate and low levels of education. The main economic activity in Ganze is agriculture Cashew nut is the major cash crop produced since 1930 (KNA, 2006). The price of cashew nut has declined substantially in recent years translating into extremely poor remuneration for farmers. The area has a total of 125 primary schools, with 48 primary schools implementing the government led HGSMP though it has low primary and secondary school enrolment rates

Study Design

This was a cross sectional study adopting quantitative approach. It entailed surveying schools implementing HGSMP and comparing the same variables with schools not implementing HGSMP. Data from the households was also collected around the schools implementing HGSM Programme and those not implementing HGSMP. Data was compared from both arms of the study for children aged between 5-15 years and that from their guardians.

Study Population

The study targeted pupils aged 5-15 years in primary schools in Ganze, Kilifi County. A total of 12 control schools and 12 intervention schools were included. Ten pupils were targeted from each school, totaling to 240 participants. Parents/guardians were paired with the pupils giving rise to a total of 480 study participants. Once enrolled, pupils were followed home for the household survey involving their parents/guardians.

Sample Size Determination

The sample size calculation was based on formula as described by Demidemko, 2008 for comparative study. Assuming that the school feeding program would result in a 10% change in all outcomes (Cohen, 1998 for small effect size), 80% power to detect the change, 5% level of precision, 80% response rates, the formula below would result in a sample size of 470.

$$n = \frac{r+1}{\mathrm{r}} \frac{(\overline{p})(1-\overline{p})(Z_{\beta}+Z_{\alpha/2})^2}{(\mathrm{p}_1 - p_2)^2}$$

Where r is the ratio of number of pupils required between the control and intervention sites, assumed to be 1:1. P will be average rates of outcomes set at 50% which is the maximum variation in proportion, Za is the Z score of a normal distribution (1.96) at 0.05 level of precision and Z score at 80% (0.84). P1- p2 is the effect size expected as a result of intervention. An additional 10% accounted for non response, hence the minimum sample size was 480. Estimated sample size for both control (120) and intervention (120) was 240. Parents (240) were paired with the each pupils giving rise to 480 participants.

Sampling Procedure

Twelve feeding schools under HGSMP were surveyed. The same number was allocated for the non feeding schools. A list of schools implementing the HGSMP were obtained and stratified per division and random sampling was used to select 12 out of 48 schools as a representative number of schools. The same technique was used for non implementing schools. For ease of data collection, attempt was made to organize the schools randomly until the required sample size was reached. The school pupils (240) were then stratified according to their grade that is standard 1-8. Thereafter random sampling was done using class registers as the sampling frame and random numbers generator and follow up of the parents to the selected pupils was made. The study targeted pupils aged between 5-15 years.

Quality Assurance

Quality assurance measures included training enumerators and data entry clerks on the survey instruments, field testing with a special focus on a 'real-life' situation, as much as possible so as to improve the process and to enhance the understanding of the study team. Field supervisors were also engaged to immediately review questionnaires on a daily basis and to rectify any inconsistencies that may arise. Data Cleaning was a multi-stage process. The data was cleaned immediately after data entry in MS Access, data was continually exported to excel and fed into SPSS during analysis until the final report was completed.

Data Management and Analysis

Once collected, quantitative data was coded and keyed-in to MS-Access which acted as the database Code-books were available for reference. Data security was ensured by creation of back-ups in removable discs and in servers. Access of the data was limited through robust pass-words to only those involved in the survey. Data was exported to Epidata Version 3.1 (EpiData Association) and Statistical Package for Social Sciences (SPSS version 23.0) for analysis. Summary/descriptive statistics was used to describe the data and generate summary tables for each level-factor. Frequencies and proportions were computed for categorical variables. For univariate comparisons of changes between the intervention and control groups, mixed-effects regression models with a random intercept (to account for within-subject correlation) was used. Covariates was included in the analysis to adjust for baseline differences between the intervention and control groups. Multiple regression model was used to assess the effect of intervention controlling for confounding factors. Results were presented in frequency distribution tables, charts and graphs. Differences between the parameters of estimate were deemed statistically significant at $p < 0.05$.

Results

Demographic Characteristics of the Respondents

Household head distribution on gender was 133 (55.4%) male and 107(44.6%) female with a significant association with disease occurrence at χ^2= 7.979, df = 1, P<0.005. The household distribution of people according to age were; 41 (17.1%) 15-19 years, 46 (19.2%) were 20-24 years, 55 (22.9%) 25-29 years, 29 (12.1%) 30-34 years, 31 (12.9%) 35-39 years, 24 (10.0%) 40-44 years and 14 (5.8%) 45-49 years, however study findings did not reveal a statistical significance between age and disease occurrence at χ^2= 7.988, df = 6, P>0.005. The current marital status in the study indicate those who have never been in a union were 102 (42.5%), married 86 (35.8%), 12 (5.0%) were living with partners, 5 (2.1%) were divorced and 26 (10.8%) no longer lived together/separated. The results indicate a significant dependency between marital status and disease occurrence at χ^2 = 12.081, df = 5, P>0.005. Educational level results indicate that 6 (2.5%) had no education, 78 (32.5%) had acquired primary education, 108 (45.0%) had secondary education and 48 (20.0%) had post secondary education. The findings on religion indicates that, 49 (20.4%) were Roman Catholic, 176 (73.3%) are Protestants/other Christians, 13 (5.4%) are Muslims, while other religions are 2 (0.8%). Study findings indicated no significant association between education levels (χ^2= 5.992, df = 3, P>0.005), religion (χ^2= 3.194, df = 3, P>0.005) and disease occurrence (Table 1).

Table1. *Cross Tabulation on Demographic Characteristics of Parents*

Occurrence of disease in the Household		Gender		χ^2	df	P-value
		Male **Yes** **Frequency (%)**	**Female** **No** **Frequency (%)**			
	Yes	68(47.9)	74 (52.1)	7.979	1	0.005
	No	65 (66.3)	33(33.7)			
		Age				
	Yes	15-19 20-24 25-29 30-34 32(22.5) 26(18.3) 32(22.5) 16(11.3)	35-39 40-44 45-49 16 (11.3) 12(8.5) 8(5.6)	7.988	6	0.239
	No	9(9.2) 20(20.4) 23(23.5) 13(13.3)	15(15.3) 12(12.2) 6(6.1)			
		Marital Status				
	Yes	Never in Union, Married, Living with partner 72(50.7) 40(28.2) 7(4.9)	Widowed Divorced Separated 4(2.8) 3(2.1) 16(11.3)	12.081	5	0.034
	No	30(30.6) 46(46.9) 5(5.1)	5(5.1) 5(5.1) 2(2.0)			
		Highest Level of Education				
	Yes	No education Primary 6(4.2) 48(33.8)	Secondary Higher 64(45.1) 24(16.9)	5.992	3	0.112
	No	0 (0.0) 30(30.6)	44 (44.9) 24(24.5)			
		Religion				
	Yes	Roman Catholic Protestant 25(17.6) 106(74.6)	Muslim Other 10(7.0) 1(0.7)	3.194	3	0.363
	No	24 (24.5) 70(71.4)	3(3.1) 1 (1.0)			

Sanitation and Hygiene

Participation in any water, sanitation and hygiene programs results indicate that, 197 (82.1%) have never participated in any water, sanitation and hygiene programs, while only 29 (12.1%) had participated and 14 (5.8%) did not know. Study findings revealed a significant relationship between participation in water, sanitation and hygiene programs and disease occurrence at χ^2= 2.339, df = 2, P<0.005. Efforts made towards finding local solutions to local water, sanitation and hygiene problem in the village constituting 217 (90.4%) who had not made efforts to find local solutions, only 9 (3.8%) had made efforts and 14 (5.8%) did not know. The household distribution was 194 (80.8%) for waste management committee, 2 (0.8%) for village elders, 2 (0.8%) for public works, 9 (3.8%) for community members/users, 9 (3.8%) for owner/private, 7 (2.9%) other and 17 (7.1%) none. Further findings indicated no significant association between efforts made towards finding local solutions to local water, sanitation and hygiene problem in sampled villages (χ^2 = 1.682, df = 2 P>0.005) as well as waste management committee engagement (χ^2= 11.396, df = 6, P>0.005 and disease occurrence.

The results on practice of putting up simple toilets indicated that 58 (24.4%) had not put up simple toilets, 166 (69.7%) had put up simple toilets and 14 (5.9%) did not know. The household head distribution was 219

(91.3%) for not using ash to disinfect and 21 (8.8%) for using ash to disinfect. The household head distribution was 61 (54.5%) for those with no latrines and 22 (19.6%) for those with latrines. The type of latrine used was 69 (28.8%) ventilated improved latrine, 38 (15.8%) unimproved (unsanitary) latrine, 29 (12.1%) open pit latrine, 22 (9.2%) trench latrines and 82 (34.2%) others at χ^2= 4.045, df = 4, P>0.005. Study findings indicated no significant association between putting up simple toilets (χ^2= 1.148, df = 2, P>0.005, not using ash as a disinfectant (χ^2= 0.071, df = 1, P>0.005), not having a latrine (χ^2 = 12.653, df = 12, P>0.005) and disease occurrence (Table 2).

Table2. *Cross Tabulations on Sanitation and Hygiene Practices at the Household Level*

Occurrence of disease in the Household	Gender: Male Yes Frequency (%)	Female No Frequency (%)	χ^2	df	P-value
	Participated in any water, sanitation and hygiene programme				
Yes	Yes 14 (9.9)	No Don't Know 118(83.1) 10 (7.0)	2.339	2	0.311
No	15(15.3)	79(80.6) 4 (4.1)			
	Households making efforts towards finding local solutions to local WASH problems				
Yes	Yes 4 (2.8)	No Don't Know 128(90.1) 10(7.0)	1.682	2	0.431
No	5(5.1)	89(90.8) 4(4.1)			
	Putting up of simple toilets				
Yes	Yes 95 (67.9)	No Other 35(25.0) 10(7.1)	1.148	2	0.563
No	71(72.4)	23(23.5) 4 (4.1)			
	Use of Ash for disinfection				
Yes	Yes 13 (9.2)	No 129(90.8)	0.071	1	0.789
No	8(8.2)	90(91.8)			
	Having a Latrine				
Yes	Yes 15(21.1)	No 42(59.2)	12.653	12	0.395
No	7(17.1)	19(46.3)			
	Types of Latrine				
Yes	Other VIP Unimproved Latrine 49(34.5) 38(26.8) 25(17.6)	Open Latrine Trench Latrines 20(14.1) 10(7.0)	4.045	4	0.400

Water

The household distribution was 224 (93.3%) for water sources not protected, 2 (0.8%) for water sources protected and 14 (5.8%) for those who did not know. Drinking of safe water was tabulated and 120 (87.0%) indicated no, 16 (11.6%) indicated yes while 2 (1.4%) did not know. The household distribution was 23 (20.5%) for water source within 500m, 9 (8.0%) was 0.5-1km and 80 (71.4%) was 1-3kms. Current study did not show a statistical significance between protecting water source (χ^2= 2.370, df = 2, P>0.005), drinking of safe water (χ^2= 2.972, df = 2, P>0.005) as well as water source proximity (χ^2= 0.102, df = 2, P>0.005) and disease occurrence

The relationship on observing the condition of water containers for collection and storage was 102 (42.5%) indicated not clean, 98 (40.8%) indicated some are clean while others not while 40 (16.7%) indicated clean. Findings indicated a significant association between observing the condition of water containers for collection and storage and disease occurrence at χ^2 = 10.649, df = 2, P<0.005. The treatment of water before use in the household indicated that all the 240 (100.0%) did not treat water before use. Water spent per day in a household indicate 21 (8.8%) were less than 20 litres, 197 (82.1%) 20-37 litres, 4 (1.7%) 38-75 litres and 12 (5.0%) more than 75 litres, findings revealed no statistical significance with disease occurrence χ^2 = 3.756, df = 4, P>0.005. Expenditure incurred on water usage at the household level shows 18 (7.5%) were less than Kshs.100, 205 (85.4%) Kshs. 101-300, 5 (2.1%) Kshs. 301-500, 5 (2.1%) Kshs. 501-1000, and 7 (2.9%) over Kshs.1000. There is a significant dependency between amount of money incurred per day on water usage and disease occurrence at χ^2= 11.978, df = 4, P>0.005.

The household distribution was 95 (39.6%) for those with no knowledge of diseases associated with water, sanitation and hygiene and 145 (60.4%) had knowledge on it. The diseases associated with water and the household head distribution was 66 (27.5%) for diarrhea, 42 (17.5%) for cholera, 33 (13.8%) for tungiasis, and 99 (41.3%) for scabies. There is a significant relationship between knowledge of diseases associated with water (χ^2 = 108.519, df = 1, P<0.005) as well as diseases associated with WASH (χ^2= 235.986, df = 3, P<0.005) and disease occurrence (Table 3).

Table3. *Cross Tabulations on Water Practices at the Household Level*

Occurrence of disease in the Household		Gender		χ^2	df	P-value
		Male **Yes** **Frequency (%)**	**Female** **No** **Frequency (%)**			
		Protection of water source				
	Yes	Yes 2 (1.4)	No Don't Know 130(91.5) 10(7.0)	2.370	2	0.306
	No	0(0.0)	94(95.9) 4(4.1)			
		Safety of drinking water				
	Yes	Yes 10 (14.3)	No Didn't know 60(85.7) 0(0.0)	2.972	2	0.226
	No	6(8.8)	60(88.2) 2(2.9)			
		Distance to source of drinking water				
	Yes	Within 500m 0.5-1KM 15 (21.1) 6(8.5)	1-3KM 50(70.4)	0.102	2	0.950
	No	8(19.5) 3(7.3)	30(73.2)			
		Condition of water containers for collection and storage				
	Yes	Not Clean Relatively Clean 72 (50.7) 47(33.1)	Clean 23(16.2)	10.649	2	0.005
	No	30(30.6) 51(52.0)	17(17.3)			

		Amount of money in Kshs spent per day on water expenditure				
	Yes	Less than 100 101-300 301-500 15 (10.6) 116(81.7) 5(3.5)	501-1000 Over 1000 1(0.7) 5(3.5)	11.978	4	0.018
	No	3(3.1) 89(90.8) 0(0.0)	4(4.1) 2(2.0)			
		Maintenance of water point				
	Yes	None Water Management Village Elder Public Works 14(9.9) 111(78.2) 0(0.0) 0(0.0)	Community User Private Other 7(4.9) 6(4.2) 4(2.8)	11.396	6	0.077
	No	3(3.1) 83(84.7) 2(2.0) 2(2.0)	2(2.0) 3(3.1) 3(3.1)			
		Knowledge of diseases associated with Water				
	Yes	Yes 95(66.9)	No 47(33.1)	108.519	1	0.000
	No	0(0.0)	98(100.0)			
		Common Diseases associated with WASH				
	Yes	Diarrhea Cholera 0(0.0) 42(29.6)	Tungiasis Scabies 1(0.7) 99(69.7)	235.986	3	0.000
	No	66(67.3) 0(0.0)	32(32.7) 0(0.0)			
		Amount of water in litres spent per day in the entire household				
	Yes	Less than 20 20-37 15(10.6) 111(78.2)	38-75 More than 75 3(2.1) 13(9.1)	3.756	4	0.440
	No	6(6.1) 86(87.8)	1(1.0) 5(5.1)			

Knowledge Attitude and Practices (KAP) towards Diarrhea Occurrence at the Household Level

The age of family member who has diarrhea and the household distribution was 1 (0.4%) for 0-5 years, 11 (4.6%) for 6-17 years, 67 (27.9%) for 18-59 years and 161 (67.1%) for 60 and above. The household distribution was 61 (25.4%) for household members who died due to diarrhea, and 165 (68.8%) didn't die due to diarrhea. Analysis indicated no statistical significance between age of family member with diarrhea (χ^2= 1.666, df = 3, P>0.005), member who died due to diarrhea (χ^2= 1.982, df = 2, P>0.005) and disease occurrence. However, the age of household members who died and household distribution was 29 (12.1%) for 0-5 years, 25 (10.4%) for 6-17 years, 27 (11.3%) for 18-59 years, 23 (9.6%) for 60 and above and 102 (42.5%) not applicable with a significant association at χ^2= 17.438, df = 7, P<0.005.

The household head distribution on health seeking behavior was 8 (3.3%) with no action, 92 (38.3%) buy medicine, 3 (1.3%) go to clinic/health facility and 91 (37.9%) given herbs (χ^2= 5.292, df = 6, P>0.005). Health facility treatment expenditure for diarrhea among household was 18 (7.5%) less than Kshs. 100, 214 (89.2%) for Kshs. 101-300, 1 (0.4%) Kshs. 501-1000 and 7 (2.9%) over Kshs. 1000 (χ^2 = 6.648, df = 3, P>0.005). Causes of diarrhea among household was 10 (10.8%) caused by rain, 52 (21.7%) dirty hands, 38 (15.8%) part of child growth, 70 (29.2%) blackmagic/witchcraft, 48 (20.0%) germs, and 6 (2.5%) dirty food. (χ^2= 7.027, df = 5, P>0.005). The above attributes were not statistically significant (Table 4).

Table4. *KAP towards Diarrhea Occurrence at the Household Level*

Occurrence of diarrhoea in the Household	Age of family member who has diarrhea		χ^2	df	P-Value
Yes	0-5 6-17 1(0.7) 8(5.6)	18-59 60 and Above 40(28.2) 93(65.5)	1.666	3	0.644
No	0(0.0) 3(3.1)	27(27.9) 68(69.4)			
	Member of household who died due to diarrhea in the last month				
Yes	Yes 93(65.5)	No None residence 39(27.5) 10(7.0)	1.982	2	0.371
No	72(73.5)	22(22.4) 4(4.1)			
	Age of household member who died				
Yes	Not Applicable 0-5 6-17 18-59 72(50.7) 11(7.7) 12(8.5) 16(11.3)	60 and Above 5 6 7 13(9.2) 10(7.0) 7(4.9) 1(0.7)	17.438	7	0.015
No	30(30.6) 18(18.4) 13(13.3) 11(11.2)	10(10.2)10(10.2)2(2.0)4(4.1)			
	What action a family member takes when he has diarrhea				
Yes	No Action Buy Medicine Go to health Facility 6(4.2) 50 (35.2) 1(0.7)	Give Herbs 6 Charcoal 97 55(38.7)0(0.0)20(14.1)10(7.0)	5.292	6	0.507
No	2(2.0) 42(42.9) 2(2.0)	36(36.7) 1(1.0) 11(11.2) 4(4.1)			
	Health facility treatment expenditure				
Yes	Less than 100 101-300 15(10.6) 122(85.9)	501-1000 Over 1000 0(0.0) 5(3.5)	6.648	3	0.084
No	3(3.1) 92(93.9)	1(1.0) 2(2.0)			
	Opinion on causes of diarrhoea				
Yes	Rain Dirty Part of child Growth 16(11.3) 32(22.5) 25(17.6)	Witchcraft l Germs Dirty food 39(27.5) 24(16.9) 6(4.2)	7.027	5	0.219
No	10(10.2) 20(20.4) 13(13.3)	31(31.6) 24(24.5) 0(0.0)			

Odds Ratios and Correlations

The odds ratio for schools without HGSMP was 14.4% more likely to suffer from diarrhea for family members (Table 4).

Family members aged 5-15 years were 9.7% more likely to suffer from diarrhea, while family members aged above 15 years were 4.4% less likely to suffer from diarrhea.

Knowledge of diseases associated with water, sanitation and hygiene when one practices open defecation had a significant dependence with the disease associated with water at a $P<0.005$. Similarly, this had a significant relationship with family members who had suffered from diarrhea at $P<0.005$. The disease associated with water had a significant relationship with family members who suffered from diarrhea at $P<0.005$ (Table 5).

Table5. *Risk Estimate*

Schools with and without HGSMP status			Value	95% Confidence Interval Lower	95% Confidence Interval Upper
Dimension	No HGSMP	Odds Ratio for Member of the household suffered from diarrhea in the last 2 weeks (No / Yes)	1.148	.323	4.074
		For cohort Age of family member who diarrhea = 5 - 15	1.097	.465	2.591
		For cohort Age of family member who diarrhea = Above 15	.956	.636	1.437
		N of Valid Cases	51		
	Have HGSMP	Odds Ratio for Member of the household suffered from diarrhea in the last 2 weeks (No / Yes)	.692	.379	1.261
		For cohort Age of family member who diarrhea = 5 - 15	.790	.538	1.158
		For cohort Age of family member who diarrhea = Above 15	1.142	.917	1.422
		N of Valid Cases	189		

Table6. *Correlations*

		Schools with and without HGSMP status	Age of family member who diarrhea	Knowledge of diseases associated with water, sanitation and hygiene practices open defecation	Which disease is associated with water	Member of the household suffered from diarrhea in the last 2 weeks
Schools with and without HGSMP status	Pearson Correlation	1	-.018	.079	-.105	.100
	Sig. (2-tailed)		.780	.220	.106	.122
	N	240	240	240	240	240
Age of family member who diarrhea	Pearson Correlation	.079	-.022	1	-.410**	.672**
	Sig. (2-tailed)	.220	.731		.000	.000
	N	240	240	240	240	240
Which disease is associated with water	Pearson Correlation	-.105	.019	-.410**	1	-.682**
	Sig. (2-tailed)	.106	.769	.000		.000
	N	240	240	240	240	240
Member of the household suffered from diarrhea in the last 2 weeks	Pearson Correlation	.100	-.066	.672**	-.682**	1
	Sig. (2-tailed)	.122	.310	.000	.000	
	N	240	240	240	240	240

*****. Correlation is significant at the 0.01 level (2-tailed).***

Discussion

Demographic characteristics e.g gender (χ^2= 7.979, df = 1, P<0.005), marital status (χ^2= 12.081, df = 5, P<0.005) and age (χ^2= 17.438, df = 7, P<0.005) revealed levels of significance. This concurs with a study by Manunebo *et al.,* 1994 which revealed that a child's risk of diarrhoeal attack is associated with age, water quality and sanitation, parental education and household size. As mentioned by Walia *et al.,* 1989 poor socioeconomic status and poor sanitation were important factors responsible for high diarrhoea morbidity due to ease of transmission of infection especially with larger households. Though the study indicated no significant association between religion (*p*= 0.363) as well as educational level (*p* = 0.112) and disease occurrence. Socio-cultural and contextual factors such as, low socioeconomic status, low education levels, social instability and gender disparities can lead communities to compromise in hygiene and sanitation issues. There are several socioeconomic and cultural cross cutting factors which affect WASH practices.

Involving the community has been suggested to be one of the most important methods to improve sustainability by making users more responsible for the operation and maintenance of programs once donors or private financers are no longer involved (DWD, 2016), this is in line with results from the current study that indicated significance in participation in WASH programmes (χ^2= 2.339, df = 2, P<0.005). However, making efforts towards finding local solutions to local water, sanitation and hygiene problem (*p*= 0.431), waste management committee (*p* = 0.077) and disease occurrence had no significance. By encouraging community involvement, it may be easier to take advantage of local resources, build local capacity for WASH, and ensure user satisfaction (Murcott, 2016). For this reason, decentralized decision making for WASH is supported by many NGOs who support ownership and management of projects to the lowest possible level (ECSP, 2011). Strategies to facilitate community involvement may include community mobilization through health clubs, community groups, meetings (Castro and Heller, 2009) or school WASH committees (Ahmed *et al.,* 1994). This study however did not reveal a significant association between having latrine (*p* = 0.395), the type of latrine (*p* = 0.400), putting up simple toilets (*p*= 0.563) and disease occurrence. As reported by Kamal Kar (2005), in India, use of PHAST is highly effective when integrated with CLTS programs that seek to create a sense of disgust and shame against open excreta disposal, current study however did not reveal significance on point of defecation (*p* = 0.060), though knowledge of diseases associated with water, sanitation and hygiene when one practices open defecation had a significant dependence (P<0.005).

Further analysis in the current study reveals a significant relationship between knowledge of diseases associated with water and disease occurrence (*p* = 0.000). In the developing world today, sanitation related diseases specifically water borne are among the leading causes of child mortality and it has been shown that the simple acts like washing hands with soap can decrease diarrhea risk by almost half. Ganze Sub County has acute water shortage and many communities in the county experience the negative effects associated with this inadequacy. This scenario has greatly led to the deterioration of sanitation and hygiene services leading to poor health and physical devastation. As Van Wijk-Sijbesma (1998) asserts, participation of the community in health interventions in water scarce areas can bring distinct benefits to water sanitation and hygiene as a whole. Further analysis in the current study indicate no significant dependency between amount of money spent on water at the household level (*p* = 0.142) as well as water spent in household per day (*p* = 0.440) and disease occurrence. It was noted that there was a lack of access to sufficient quantities of water and soap at the unit of both school and households that impedes personal hygiene (Luby *et al.,* 2007). WHO recommends minimum availability of 100 L of water per capita per day for all purposes (WHO, 2011). Current study indicate association between observing the condition of water containers for collection and storage (χ^2= 10.649, df = 2, P<0.005) and preferred water treatment methods (χ^2= 11.978, df = 4, P<0.005) with disease occurrence, contrary observations have been made in a study conducted in Botswana, where the drinking water containers were kept without lids (Tubatsi *et al.,* 2015). Current study however did not reveal a significant association between protecting water sources (p = 0.306) as well as safety of drinking water (p= 0.226). The observed health gains are associated with differences in community involvement and the participatory approach adopted. This study however did not reveal a significant association between using ash for disinfection (p = 0.789) and disease occurrence.

Study findings indicated no significance association between age of family member who had diarrhea (p= 0.644), household members who died from diarrhea (p=0.371) as well as member of family with diarrhea (p= 0.507) and cause of diarrhea (p= 0.219). Current study does not also indicate any significant relationship between action taken when pupils have diarrhea (p= 0.571), cause of diarrhea identified (p= 0.864) and ways of preventing diarrhea (p= 0.870), and disease occurrence. The theoretical foundation in the Health Belief Model (HBM), integrates people's knowledge, perceptions, attitude and practices to a disease in establishing trends of infection (Gelaw *et al,* 2013).

Conclusions and Recommendations

The study concluded that there was a positive and significant relationship between the variables of the study and disease occurrence includes; Demographics, Knowledge levels, Diseases associated with water, Participation in WASH activities, Water treatment and Storage significantly influence disease occurrence in Ganze, Kilifi County, Other attributes i.e putting up simple latrines, point of defecation, protecting water source, safety of drinking water, member of family suffering from diarrhoea, educational levels and religion revealed no level of significance.

In order to reduce burden of sanitation related diseases the health care providers should adopt effective and sustainable disease management measures. School and community-based health education is also imperative among these communities to significantly reduce the infestation and morbidity from tungiasis and diarrhoea. Besides periodic health education proper sanitation practices are imperative among these communities and schools in order to curtail the morbidity and mortality caused by diarrhea and tungiasis. This study recommends a focus on change in practices in the community and in schools to complement existing efforts aimed at controlling tungiasis and diarrhoea.

List of Abbreviations

CLTS: Community Led Total Sanitation

ESACIPAC: Eastern and Southern Africa Centre of International Parasite Control

KEMRI: Kenya Medical Research Institute

HGSMP: Home Grown School Meal Programme

MDG: Millennium Development Goals

PHAST Participatory Hygiene and Sanitation Transformation

SERU: Scientific Ethical Review Committee

SHNP: School health and nutrition programmes

SPSS: Statistical Package for Social Sciences

STLS: School total led sanitation

UN: United Nations

WASH: Water Sanitation and Hygiene

Declarations

Ethics Approval and Consent to Participate

This study was approved by the KEMRI Ethical Review Committee (SSC/ERC protocol No. (3029). The study used questionnaires uniquely coded with results of each questionnaire being kept in strict confidence. Participating in the study was voluntary and one could withdraw at any point. The purpose of the study and its objectives were explained to local authorities, opinion leaders, headteachers, and community members. Informed consent and assent was obtained from the participating respondents in writing. Parental consent was obtained for participants under 16. Subjects were assured about confidentiality of information obtained from them and personal identifiers were removed from the data set before analysis.

Availability of Data and Materials

That all data used in the manuscript is available for sharing; including all relevant raw data, will be freely available to any scientist wishing to use them for non-commercial purposes, without breaching participant confidentiality.

Authors' Contributions

JM- conceived of the study, participated in its design coordination, and helped to draft the manuscript.

SK-participated in the design, coordination and helped to draft the manuscript.

JM- participated in the design of the study and helped to draft the manuscript.

GK-participated in the design, coordination and helped to draft the manuscript.

All authors read and approved the final manuscript.

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