BATTICALOA MEDICAL JOURNAL
Volume 15, Issue 01 May 2022, Biannually
The official publication of the Batticaloa Medical Association
ISSN 1800- 4903

Original research Papers

Risk factors of common waterborne diseases in Jaffna district

Subramaniam Sivaganesh[1], Suganja Selvananthan[2], Amirtharajah Thileeban[3]

1. Provincial Epidemiologist, Provincial Director of Health Services, Northern Province.
2. Additional Medical Officer of Health, Medical Officer of Health, Pointpedro.
3. Deputy Regional Director of Health Services, Regional Director of Health Services, Kilinochchi.

Abstract:

Objective: To determine the risk factors of common waterborne diseases in Jaffna district.

Methodology: We conducted acase control study from March to September 2015 with 205 cases and 205 controls using an interviewer administered questionnaire by systematic random sampling method. All cases with the final diagnosis as dysentery or enteric fever were considered as cases and controls were selected from the same area of the patient/case. Ethical clearance was obtained from the ethical review committee of Faculty of Medicine, Jaffna. Simple descriptive statistics, with OR and LR were used to describe the results.

Results: Mean age of the respondents was 8.98 years (SD= 13.035). Persons with age above 10 years had more risk for getting enteric fever or dysentery (OR=1.848, p=0.017). Persons with improved water source (p=0.002), safe drinking water (p=0.011), habit of hand washing with soap before meal (p=0.007), children with the past history of same disease (p=0.02), having good knowledge of typhoid transmission (p=0.006) had less risk for enteric fever or dysentery.

Conclusion: age, water source, drinking water, hand washing with soap before meal, past history of food/water borne disease, knowledge of typhoid transmission were the variables had statistically significant association with common waterborne diseases. Unsafe water source, no hand washing with soap before meal, no past history of food/water borne disease and poor knowledge of typhoid transmission had shown significant association in multivariate analysis.

Keywords:
waterborne diseases, Enteric fever, Dysentery, risk factor, Jaffna district.

Introduction

Incidence of some infectious diseases is on the rise in developing countries. According to World health statistics 2012, age-standardized mortality rates for Communicable diseases were 14 per 100000 population in Austria and 1060 per 100 000 population in Central African Republic (WHO 2012). People suffer from diseases due to contaminated food or water. It was estimated that each year food borne diseases causes approximately 76 million illnesses, 325000 hospitalizations, 5000 deaths in the USA and 2 366 000 cases, 21 138 hospitalizations, 718 deaths in England and Wales(2).

An infectious disease spread through the water and cause illness by ingesting the agent with water is called water borne disease(3). In Jaffna enteric fever and dysentery are the common water borne diseases (4). Diagnosis of enteric fever: The causative organisms can be isolated from blood early in the disease and from urine and faeces after the first week. Blood culture is the diagnostic mainstay of typhoid fever. Serological tests based on agglutination antibodies (SAT) are of little diagnostic value because of the limited sensitivity and specificity. However, the demonstration of a fourfold rise in antibody titre is confirmatory of salmonella infection. But because of uncontrolled antibiotic usage by both doctors and patients themselves (over the counter), none of the above is fully appropriate in Jaffna. So, the ultimate diagnosis is done by treating physician considering all clinical features and above lab results.

Diagnosis of Bacillary dysentery: Clinical feature is mainly supportive for the diagnoses. Culture (growing the bacteria in the laboratory) of freshly obtained diarrhea fluid is the only way to be certain of the diagnosis. But even this is not always positive, especially if the patient is already on antibiotics (5).

According to the Epidemiology Unit, Sri Lanka, in 2014, out of 4795 reported dysentery cases1067 were from Jaffna (22.3%) and out of 1032 reported enteric fever cases 321 were from Jaffna (31.1%). In Jaffna, among 1678 reported cases of common notifiable diseases 925 were (55.1%) food and waterborne (dysentery, enteric fever and food poisoning) diseases in 2011 and they were 3958&1428 respectively in 2014(6). These data were generated from inward patients of government hospitals mainly. Relatively high number of patients with the diseases may be managed in private hospitals and OPDs of government hospitals. Same time there was a gap between the data derived from indoor morbidity and mortality report (IMMR) and reported through notifications(7).

Immunization is a short term solution for the control of food and water borne infections. Factors affecting the food and water safety must be studied and sustainable interventions should be planned according to the findings. Though Sri Lanka has a system to monitor both food and water quality through local government authorities and health department we could not maintain a better food and water quality in all parts of the island due to issues in the respective places. Though there are enough literature about risk factors for water/food borne diseases(8) [5, 6,8], we need to study what are the factors predominantly play role in the transmission of disease in our areas. Then only it's easy to plan effective interventions to minimize the incident of the diseases in our areas.

Our aim/objective was to determine the risk factors/ associated factors of common waterborne diseases (enteric fever and dysentery) among patients admitted to 5 major hospitals in Jaffna district.

Objective

To determine the risk factors of common waterborne diseases (enteric fever and dysentery) in Jaffna District.

Methods:

Design and setting

We conducted prospective case control study from March to September 2015 in all four base hospitals, teaching hospital and households (persons) in Jaffna district.

Sample

We recruited 410 (368(184+184)+ 10% non-response allowance) samples which was calculated by "WinPepi" software with 5% significant level, 80% power, 0.66 exposure(9) (using unsafe water for drinking) in cases and Odds ratio 2 by systematic random sampling method.

All cases with the final diagnosis (by the consultant physician or paediatrician as this is the most suitable method for the context-see introduction, p.3) as dysentery or enteric fever were considered as cases irrespective of any age and controls were selected from the same area of the patient/case. A person without any faeco-oral disease within past 6 months (confirmed by detailed history about fever and or diarrhoea) was taken as control. First patient from the ward discharge/diagnosis book was taken and every third case was taken; one out 5 neighbouring house was selected by lottery method and the 1st person above 6 month of age according to the English alphabetical order was selected from the house as control. Persons who stay temporarily and those cannot give the information due to physical or mental status were excluded.

Measures

Data was collected using interviewer-administered questionnaire with variables of sex, age, education level, occupation, water source, drinking water, outside eating habit (within one month), household food safety, safe toilet , hand washing with soap before meal, hand washing with soap after defecation, past history of food/water borne disease, refuse in the environment, knowledge of typhoid agent, knowledge of dysentery agent, knowledge of Typhoid Transmission and knowledge of dysentery transmission

The informed written consent was obtained from the participants; the privacy was maintained while obtaining data by gathering at separate place individually. If the patient's age was less than 18 years, consent and assent took from parents or guardian.

Pre test

Pretest was done before the actual study period from same setting.

Ethical considerations

Ethical clearance was obtained from the Ethical review committee of Faculty of Medicine, University of Jaffna.

Analysis

We analyzed 410 completed questionnaires using SPSS 21. Simple descriptive statistics, Odds ratio & multivariate analysis were used to describe the results.

Results

Background data

The median age of the subjects (403) was 5 years and mean was 8.98 years (SD=13.035). Fifty nine percentages of the subjects were male (Fig. 1). Most of the subjects were non-school going aged children (Fig.2).

Figure 1: Distribution of subjects according to sex

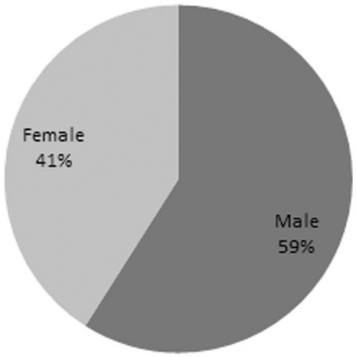
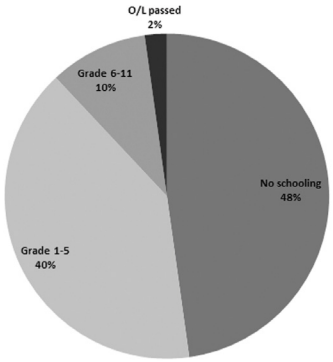


Figure 2: Distribution of subjects according to the education



Risk factors for enteric fever and dysentery

Out of the studied variables following variables had statistically significant association with enteric fever or dysentery (Table 1). Compared to the children aged between 6 months to 10 years, children aged above 10 years had 1.85 times(95% CI=1.117-3.060) more risk for getting enteric fever or dysentery. Compared to persons who used non- improved water source, persons who used improved water source had 0.54 times (95% CI=0.36-0.80) less risk for getting enteric fever or dysentery. Compared to persons who used un- safe water, persons who used safe water had 0.60 times (95% CI=0.40-0.89) less risk for getting enteric fever or dysentery. Compared to persons who practiced poor habit of hand washing before meal, persons who practiced the habit of hand washing with soap before meal had 0.57 times (95% CI=0.37-0.86) less risk for getting enteric fever or dysentery. Compared to children who did not had past history of food/water-borne disease, children with past history of same disease had 0.53 times (95% CI=0.31-0.91) less risk for getting enteric fever or dysentery. Compared to the respondents with poor knowledge about typhoid transmission, those with good knowledge of typhoid transmission had 0.22 times (95% CI=0.07-0.64) less risk for getting enteric fever or dysentery. Other variables (sex, education level, occupation, outside eating habit (within one month), household food safety, safe toilet, hand washing with soap after defecation, refuse in the environment, knowledge of typhoid, knowledge of dysentery agent, knowledge of dysentery transmission) did not show statistically significant association with enteric fever or dysentery.

Unsafe water source, no hand washing with soap before meal, no past history of food/water borne disease and poor knowledge of typhoid transmission had shown significant association in multivariate analysis.

Table 2: Multivariate analysis of Factors associated with enteric fever / Dysentery

Exposure	Beta	SE	OR	95% CI Lower limit	Upper limit	P value
Unsafe Water source	0.59	0.23	1.80	1.14	2.84	0.011
No Hand washing with soap before meal	0.73	0.26	2.07	1.25	3.41	0.005
No Past history of food/water borne disease	0.78	0.34	2.18	1.12	4.24	0.021
Poor Knowledge of Typhoid Transmission	1.21	0.58	3.36	1.09	10.44	0.036

Model Chi square- 30.14, df- 4 and p value -<0.001.
Model Nagelkerke's R square- 0.12

Discussion

Age, water source, drinking water, hand washing with soap before meal, past history of food/water borne disease, knowledge of typhoid transmission were the variables had statistically significant

association with common waterborne diseases (enteric fever and dysentery). Unsafe water source, no hand washing with soap before meal, no past history of food/water borne disease and poor knowledge of typhoid transmission had shown significant association in multivariate analysis.

The principal investigator worked as regional epidemiologist in Jaffna district. During that period he learned that waterborne diseases were occurring in certain households in a same local areas where majority of the houses were not affected. So to elicit the real difference in risk factors between them, community controls near the patients' houses were selected.

Because of an outbreak of dysentery among children during the study period most of the study participants were non-school going aged children (Fig.2).

These findings are in consistency with other investigated outbreaks of typhoid in Bangladesh where contaminated drinking water was found as risk factors. Environmental condition around open well supported the possibilities of its contamination. Faecal contamination seen in water samples provided additional evidence for the source of infection(10). Same findings were observed in Kenya also. But the age group at risk was below 10 years in their study as ours (11). Children 2–4 years old had the highest incidence in an Indian study also (12). In contrast to our study, a Canadian study investigated the demographic determinants of acute gastro-intestinal illness (AGI) stated females were significantly more likely to have AGI than males (13). In an Australian study, women between the ages of 25 and 64 years both with and without AGI were compared; the study found that 18% of women with AGI had at least one child less than five years of age in their household, compared to 5% of women without AGI. Thus, it is possible that females are at an increased risk due to the presence of and interaction with young children within the household (14).

Another study in Bangladesh revealed that young children, persons who consumed un-boiled water and area with poor drainage were at higher risk of developing typhoid (15). Same findings were observed in China and in our study too (16).

Persons with safe drinking water and hand washing with soap before meal had less risk for getting enteric fever or dysentery as significant in our study. These results are broadly consistent with a findings of a systematic review. It expressed several water, sanitation and hygiene interventions were associated with lower risk of diarrhoeal morbidity. Point-of-use filter interventions with safe storage reduced diarrhoea risk by 61% (RR = 0.39; 95% CI: 0.32, 0.48); piped water to premises of higher quality and continuous availability by 75% and 36% (RR = 0.25 (0.09, 0.67) and 0.64 (0.42, 0.98)), respectively compared to a baseline of unimproved drinking water; sanitation interventions by 25% (RR = 0.75 (0.63, 0.88)) with evidence for greater reductions when high sanitation coverage is reached; and interventions promoting hand washing with soap by 30% (RR = 0.70 (0.64, 0.77)) vs. no intervention (17). But a survey conducted in Mozambique revealed that although there is no conclusive evidence of the additive effects of the water supply, sanitation and hygiene promotion on diarrhoea, it seems reasonable to design comprehensive programmes that take into account the joint improvement of these three factors (18).

Our study resulted persons with good knowledge of typhoid transmission had less risk for getting enteric fever or dysentery. Nearly same finding observed in a study that effective locally-informed education programs have the potential for clarifying misconceptions, improving practical knowledge, and instigating behavioral changes, which in turn may reduce diarrhea-related mortality along a more sustainable long-term platform than what has been undertaken to date in the Niger River Basin of Mali (19).

A study demonstrated that highly localized clustering of typhoid fever during an epidemic in an urban African setting suggested the targeted intervention (20). It is necessary to understand how food becomes unsafe to eat and what proactive measures can be taken to keep food safe to prevent foodborne illness.

Conclusions and Recommendations

Persons with age above 10 years had more risk for getting enteric fever or dysentery. So it's recommended to do more awareness programs to secondary school children in both government and private education institutions. Persons with improved water source had less risk for getting enteric fever or dysentery. So the government or non-government organizations need to take measures to improve the water sources as this is a known problem in Jaffna district. Persons with safe

drinking water had less risk for getting enteric fever or dysentery. So the people must be educated to use safe drinking water. Persons with the habit of hand washing with soap before meal had less risk for getting enteric fever or dysentery. Hence it's essential to promote hand washing with soap before meal in both personal and public settings. Children with the past history of same disease had less risk for getting enteric fever or dysentery. It shows that the children with the past history of the disease had some opportunity to improve their context may be due to the visits of PHI or PHM to follow the notification. It indirectly tells that general public health education should be improved. Persons with good knowledge of typhoid transmission had less risk for getting enteric fever or dysentery. This is also indirectly tells that general public health education need to be improved. Unsafe water source, no hand washing with soap before meal, no past history of food/water borne disease and poor knowledge of typhoid transmission had shown significant association in multivariate analysis (table2). So, in long-term, safe water supply, proper hand washing practice and improvement of knowledge about waterborne diseases need to be ensured by the relevant authorities for healthy future.

Funding details

Self-funded

Acknowledgement

The authors wish to acknowledge participants, ward staff (Consultants, medical officers, nursing officers especially ICNO), RDHS, Director, Teaching hospital-Jaffna, Medical superintends of base hospitals and statistical unit staff.

Conflict of interest

The authors report no conflict of interest

References

1. WHO. World Health Statistics [Internet]. Vol. 27, WHO World Health Organization. 2012. 171 p. Available from: http://books.google.com/books?hl=en&lr=&id=osms0oMN_qwC&oi=fnd&pg=PA7&dq=World+Health+Statistics&ots=iZU1J3AqjI&sig=sIBAWCK7qn9DYyQU_cHVERTK4Ks

2. Adak GK, S M Long SJO. Trends in indigenous foodborne disease and deaths, England and Wales: 1992 to 2000. 2002;51:832–41.

3. Kumud Park. Park's textbook of PREVENTIVE AND SOCIAL MEDICINE. 22nd ed. M/s Banarsidas Bhanot publishing; 2013.

4. Ministry of Healthcare and Nutrition. Quarterly Epidemiological Bulletin. 2014;

5. Epidemiology unit. Bacillary dysentery fact sheet. Colombo; 2012.

6. Epidemiology unit. WER 2015 Sri Lanka- Vol. 42 No. 01. Colombo; 2015.

7. Regional Director of Health Services. Statistical Hand Book 2014. Jaffna; 2015.

8. Chin J. Control of Communicable Diseases Manual (17th ed.) (selected excerpts). 2000. 624 p.

9. UNOCHA. SRI LANKA: Lack of safe drinking water leading to upsurge in health problems - Sri Lanka | ReliefWeb [Internet]. 2010 [cited 2022 Feb 14]. Available from: https://reliefweb.int/report/sri-lanka/sri-lanka-lack-safe-drinking-water-leading-upsurge-health-problems

10. Ram PK, Naheed a, Brooks W a, Hossain M a, Mintz ED, Breiman RF, et al. Risk factors for typhoid fever in a slum in Dhaka, Bangladesh. Epidemiol Infect. 2007;135(3):458–65.

11. Akullian A, Ng'eno E, Matheson AI, Cosmas L, Macharia D, Fields B, et al. Environmental Transmission of Typhoid Fever in an Urban Slum. PLoS Negl Trop Dis. 2015;9(12):1–14.

12. John J, Van Aart CJC, Grassly NC. The Burden of Typhoid and Paratyphoid in India: Systematic Review and Meta-analysis. PLoS Negl Trop Dis [Internet]. 2016;10(4):e0004616. Available from: http://dx.plos.org/10.1371/journal.pntd.0004616

13. Majowicz SE, Horrocks J, Bocking K. Demographic determinants of acute gastrointestinal illness in Canada : a population study. 2007;8:1–8.

14. Hall G V., Kirk MD, Ashbolt R, Stafford R, Lalor K, Bell R, et al. Frequency of infectious gastrointestinal illness in Australia, 2002: regional, seasonal and demographic variation. Epidemiol Infect. 2006 Feb;134(1):111–8.

15. Dewan AM, Corner R, Hashizume M, Ongee

ET. Typhoid Fever and Its Association with Environmental Factors in the Dhaka Metropolitan Area of Bangladesh: A Spatial and Time-Series Approach. PLoS Negl Trop Dis. 2013;7(1):12–5.
16. Nie C, Li H, Yang L, Zhong G, Zhang L. Socio-economic factors of bacillary dysentery based on spatial correlation analysis in Guangxi Province, China. PLoS One. 2014;9(7).

17. Wolf J, Hunter PR, Freeman MC, Cumming O, Clasen T, Bartram J, et al. Impact of drinking water, sanitation and handwashing with soap on childhood diarrhoeal disease: updated meta-analysis and meta-regression. Trop Med Int Heal. 2018;23(5):508–25.

18. González-Gómez F, Lluch-Frechina E, Guardiola J. Water Habits and Hygiene Education to Prevent Diarrhoeal Diseases: The Zambezi River Basin in Mozambique. African Dev Rev [Internet]. 2013 Dec 1 [cited 2022 Feb 24];25(4):563–72. Available from: https://onlinelibrary.wiley.com/doi/full/10.1111/1467-8268.12050

19. Halvorson SJ, Williams AL, Ba S, Dunkel F V. Water quality and waterborne disease in the Niger River Inland Delta, Mali: A study of local knowledge and response. Health Place. 2011 Mar 1;17(2):449–57.
20. Polonsky JA, Martínez-Pino I, Nackers F, Chonzi P, Manangazira P, Van Herp M, et al. Descriptive Epidemiology of Typhoid Fever during an Epidemic in Harare, Zimbabwe, 2012. PLoS One [Internet]. 2014 Dec 8 [cited 2022 Feb 24];9(12):e114702. Available from: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0114702