Factors of Acute Diarrhoea among Children of Under Five Years Old in Sabah, Malaysia: A Case-Control Study

Syed Sharizman Syed Abdul Rahim[1], Shamsul Azhar Shah[2], Mohammad Saffree Jeffree[1], Zahir Izuan Azhar[4], Mohd Rohaizat Hassan[2], Nazarudin Safian[2] & Narinderjeet Kaur[1]

[1]Department of Community and Family Medicine, Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, 88400 Kota Kinabalu, Sabah, Malaysia, [2]Department of Community Health, Faculty of Medicine, Universiti Kebangsaan Malaysia, 56000, Bandar Tun Razak, Cheras, Kuala Lumpur, Malaysia, [3]Department of Population Health and Preventive Medicine, Faculty of Medicine, Universiti Teknologi MARA (UiTM), 47000, Sungai Buloh, Selangor, Malaysia

Abstract

Acute diarrhoea is a major public health problem and is the second leading cause of death in children. It has implications in terms of morbidity and mortality especially in the under five years old age group. The purpose of this study was to determine the factors associated with acute diarrhoea among children under 5 years old in Sabah. This was a case-control study involving 584 samples in four districts in Sabah. Analysis with multiple logistic regression discovered the associated factors of acute diarrhoea among under 5 years old were child's age, single parents aOR5.209 (95%CI 1.09-25.01), Peribumi Sabah mother aOR1.542 (95%CI 1.01-2.34), unemployed mother aOR1.783 (95%CI 1.16-2.75), less than RM2,000 monthly household income aOR1.643 (95%CI 1.08-2.49), no garbage collection aOR1.923 (95%CI 1.24-2.98), adjacent open garbage aOR1.888 (95%CI 1.23-2.91), average rainfall of 151mm or more aOR1.768 (95%CI 1.22-2.56) and less than 1 year of breastfeeding aOR1.685 (95%CI 1.11-2.55). The study has revealed the need to improve the overall level of hygiene and sanitation in the population.

Keywords: *Diarrhoea, children, Sabah, factors, case-control.*

Introduction

Diarrhoea is still a major public health problem, causing notable numbers of morbidity and mortality worldwide. It is the second leading cause of death in children under five years old. Around 1.8 million people die each year from diarrhoeal disease, with 90% are children who are under 5 years old from developing countries[1]. The outcome of the infection may have effects in electrolyte loss, dehydration, shock and sometimes death. Diarrhoea has morbidity effects, which include stunting of growth, delay in neurological development, concomitant infections, diarrhoea recurrence and failure to thrive[2] worldwide. The present study was undertaken to further define research priorities for the prevention and treatment of diarrhoea in low and middle income countries. We used the Child Health and Nutrition Research Initiative (CHNRI).

In Malaysia, diarrhoea persistently contributes to the national's public health issue, with at least 13 million episodes of acute diarrhoea occurring annually. Acute diarrhoea is under reported with only less than 0.1% of cases actually being captured by the national surveillance program. Gastrointestinal infection is the second most common cause for hospital admissions to public hospitals and with more hospitalizations; there is a significant burden placed on health care costs. For example the cost for inpatient care of childhood rotavirus

Corresponding Author:
Syed Sharizman Syed Abdul Rahim
Department of Community & Family Medicine, Faculty of Medicine & Health Sciences, Universiti Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia
e-mail: syedsharizman@gmail.com

diarrhoea alone in Malaysia was estimated to be up to US$1.8 million annually [3].

Hospitalizations for acute diarrhoea were found to be higher in East Malaysia and were particularly high in the indigenous minority. It may represent a true prevalence of hospitalization but in East Malaysia there is proportionately less access to private medical facilities and a higher preference to hospitalize patients because of the patients' travel distances. Besides that, many children who have mild illnesses do not seek medical treatment and this can indicate that thousands more in Malaysia are unreported [4]. This study was conducted to determine the factors associated with acute diarrhoea among those under 5 years old in four districts of Sabah.

Material and Method

This study was conducted in four districts of Sabah which are Kota Kinabalu, Penampang, Putatan and Papar. The major ethnic groups here are Kadazan/ Dusun, Bajau, Murut, Malay, Chinese, Indian and other Bumiputera. This is a case-control study involving 584 respondents, which consisted of 292 in each group of case and control. The cases were children under 5 years old with acute diarrhoea selected randomly from public health centres in the four districts of Sabah over the period of 11 months. Acute diarrhoea is defined as having three or more episodes of loose stools in any 24-hour period within the past four weeks (28 days) before the interview. The controls were respondents under 5 years old who attended the same health care centres for problems other than gastrointestinal diseases.

A questionnaire was adapted and then modified to suit the local context with permission from authors in a previous study done in Brazil, which looked at risk factors for diarrhoea in a middle income country [5]. It underwent forward translation to Malay and was reviewed by experts for content and language. A pre-test was conducted, and the comments and discussion were taken into account for the final adjustments in the questionnaire. The questionnaire incorporates demographic, socioeconomic, food preparation, disease contact and environmental variables. The data was analysed with SPSS 20.0 for bivariate analysis then with logistic regression. Respondents who voluntarily agreed to take part had to give their written consent and they were given full information regarding the research. There were no invasive procedures involved.

Findings: There were 614 respondents interviewed and 30 were rejected. Out of the rejected respondents, 18 did not have a complete address or had missing data while 12 attended the health centres but did not originally stay in the four districts. The final sample size were 584 respondents, which consisted of 292 in each group of case and control. A total of 584 samples, which were 292 cases and 292 controls which included from Kota Kinabalu with 182 (62.3%) respondents, 48 (16.4%) from Penampang, 53 (18.2%) from Putatan and 9 (3.1%) from Papar for each case and control group. In terms of the child's age the mean age was 2 years old for cases and 1 year 8 months for controls. The variables were then analysed with multiple logistic regression.

The main factors that influence acute diarrhoea among those under 5 years old were child's age, single parents aOR5.209 (95%CI 1.09-25.01), Peribumi Sabah mother aOR1.542 (95%CI 1.01-2.34), unemployed mother aOR1.783 (95%CI 1.16-2.75), less than RM2,000 monthly household income aOR1.643 (95%CI 1.08-2.49), no garbage collection aOR1.923 (95%CI 1.24-2.98), adjacent open garbage aOR1.888 (95%CI 1.23-2.91), average rainfall of 151mm or more aOR1.768 (95%CI 1.22-2.56) and less than 1 year of breastfeeding aOR1.685 (95%CI 1.11-2.55).

Table: Multiple logistic regression analysis of cases and controls

Risk factor	ß	Standard error	Wald	P	Adjusted odds ratio (aOR)	95% CI
Child's age						
<6 (0)						
6-11 (1)	-0.896	0.556	2.598	0.11	0.408	0.14-1.21
12-23 (2)	-1.769	0.503	12.369	<0.001*	0.171	0.06-0.46
24-35 (3)	-1.747	0.493	12.546	<0.001*	0.174	0.07-0.46
36-47 (4)	-1.949	0.497	15.400	<0.001*	0.142	0.05-0.38
48-59 (5)	-2.427	0.513	22.363	<0.001*	0.088	0.03-0.24

Risk factor	ß	Standard error	Wald	P	Adjusted odds ratio (aOR)	95% CI
Parent's marital status Single (1) Married (0)	1.650	0.800	4.251	0.04*	5.209	1.09-25.01
Mother's Ethnicity Peribumi Sabah (1) Others (0)	0.433	0.214	4.097	0.04*	1.542	1.01-2.34
Mother's Occupation Unemployed (1) Employed (0)	0.578	0.220	6.886	0.01*	1.783	1.16-2.75
Households income per month <RM 2000 (1) ≥RM 2000 (0)	0.497	0.212	5.486	0.02*	1.643	1.08-2.49
Garbage collection No (1) Yes (0)	0.654	0.223	8.599	0.003*	1.923	1.24-2.98
Open garbage Yes (1) No (0)	0.636	0.220	8.353	0.004*	1.888	1.23-2.91
Average rainfall 151mm≥ (1) ≤150mm (0)	0.570	0.188	9.192	0.002*	1.768	1.22-2.56
Breastfeeding <1 year (1) ≥1 year (0)	0.522	0.212	6.053	0.01*	1.685	1.11-2.55
Constant	-4.479	0.882	25.799	<0.001*	0.011	

*significant OR

Nagelkerke $R^2 = 0.234$

Forward LR Multiple Logistic Regression model was applied.

Multicollinearity and interaction term were checked and not found.

Hosmer-Lemeshow test, (p=0.893), classification table (overall correctly classified percentage =70.1%) and area under the ROC curve (73.6%) were applied to check the model fitness.

Discussion

In a previous Malaysian study on acute diarrhoea, young adults had the highest incidence of acute diarrhoea while children of under five years had a slightly lower incidence [6]. This may be due to their active lifestyle and tendency to be eating outside rather than at home. Meanwhile, in a cross-sectional study among 274 children aged 12–59 months in low socioeconomic city areas of East Jakarta, it was shown that the possibility of getting diarrhoea was amplified in children aged less than 2 years old, and they were more susceptible if they had mothers with poor food hygiene practices, and the risk was extremely high during the weaning period [7]food preparation, cleanliness of utensils, water source and safe drinking water, habits of buying cooked food, child's bottle feeding hygiene, and housing and environmental condition were collected through home visit interviews and observations by fieldworkers. Thirty-six practices were scored and classified into poor (median and below. The most common age in most diarrhoea studies in children was 6 to 11 months, which can be due to tainted weaning sustenance. Furthermore, crawling begins at this time and the hazard of ingesting tainted materials may cause diarrhoea. However the risk declines after 6 to 11 months; most likely due to strengthened immunity after repeated exposure to pathogens [8].

There is a high incidence of poverty in rural and urban Sabah as well as in rural Sarawak. Various method for measurement were used, with almost similar findings [9]. In most underdeveloped nations the prevalence of diarrhoea was found to be higher among rural children than among urban children. This could be due to

inadequate access to clean, safe water and sanitation infrastructures in the rural areas [8]. Socioeconomic status and parental care also play a part. Single motherhood is an important risk factor for children's nutritional status and survival before the age of 5 years. It puts a family at disadvantage, especially in terms of the child's health and survival chances but could be reduced when these mothers have access to a better economy, improvements in parental help and healthy behaviour. This could come in the form of welfare benefits and other family-based interventions. Interventions that focuses on single mother families may help reduce under-5 mortality [10].

Our study findings of Pribumi Sabah as the ethnic group with the highest number of acute diarrhoea cases echoes similar findings from other studies[6]. As we know, sociocultural status does play a part in foodborne illness [11]. In terms of ethnicity, Malaysia is regarded as a diverse, multi-ethnic country. The government is trying to close the gap by relocating the deprived groups to new settlements at the fringe of towns[12]. In other countries like Nepal, ethnicity is found in relation to caste, adding to customary social class categories. Some ethnic groups are usually underprivileged. The underprivileged are at a disadvantage in terms of socioeconomic status [13]. It is important for ethnicity data be included in studies, as this data can contribute to analysis of social and economic disparities. Ethnicity is related to a range of other cultural, demographic, socioeconomic, and ecological variables[14].

In a cross-sectional study done in Ethiopia on 768 households, it was found that children who were partly receiving breast milk were twice more likely to get diarrhoea compared to those exclusively receiving breast milk. The risk was three times higher for those who received less than 1-year duration of breastfeeding. During this period there is inborn immunity and less exposure to pathogens. Once the child has lost inborn immunity, starts to wean, and is exposed to various pathogens from eating contaminated food, diarrhoeal cases will start to increase[15]. Interventions such as exclusive breastfeeding, continuation of breastfeeding until 24 months of age, complementary feeding to improve nutrition, along with improved sanitation, are positive ways to influence the prevention and outcome of diarrhoea. There is also recommendation for routine zinc supplements in managing childhood diarrhoea, but it is not currently practiced in many countries [16]. Breastfeeding is vital and it should be continued even during diarrhoeal episode[17] the objective of this study was to examine household management of childhood diarrhoea. A simple random sample of households was selected from the Health and Demographic Surveillance Site-León. Parents or caretakers of children below five years of age, who developed diarrhoea (n = 232. In addition, special health education programs should cater for mothers or caretakers to promote proper feeding practices, in consideration of nutritional status according to standard policies[18].

Households that are located adjacent to drainage openings are likely to experience diarrhoea because of waste collection that carry diarrhoea pathogens[19]. In managing daily waste, some households either tend to keep their trash bins in the house or around the perimeter of their homes. Trash bins that are not covered tend to draw houseflies. Food may be contaminated by these flies through the action of poor waste handling, and this may thus increase the incidence of diarrhoea in children[20]. Open disposals are also breeding site for insects, which may carry diarrhoea pathogens to water and food[8].

There is a strong relationship between diarrhoea infections and climate [7]food preparation, cleanliness of utensils, water source and safe drinking water, habits of buying cooked food, child's bottle feeding hygiene, and housing and environmental condition were collected through home visit interviews and observations by fieldworkers. Thirty-six practices were scored and classified into poor (median and below. A study in Congo which used 20 years of historical data on temperature and rainfall found that increased rainfall indirectly promotes an increase in new cholera cases which causes acute diarrhoea. A reduction in cholera cases could be seen when there is an increase in average temperature that promotes a reduction in rainfall [21].

Conclusion

The significant factors elicited in this study shows the need to improve the overall hygiene and sanitation in the affected areas. A long-term plan in developing these necessities would surely benefit the population and elevate in general the status of public health in the region.

Acknowledgement: We would like to thank the Director General of Health Malaysia for his permission to publish this article. The authors would also like to express our gratitude to the Sabah State Health Department, particularly Kota Kinabalu Area Health

Office, Penampang Area Health Office, Papar Area Health Office and Putatan District Health Office.

Conflict of Interest: None.

Source of Funding: This study was self-funded by the researchers.

Ethical Clearance: The ethics clearance and approval taken from the Sabah State Health Department, Universiti Kebangsaan Malaysia (FF-2014-319) and the National Medical Research Register (NMRR-14-331-19140), Malaysia.

References

1. Oketcho R, Karimuribo E. Epidemiological factors in admissions for diarrhoea in 6-60-month-old children admitted to Morogoro Regional Hospital, Tanzania. … African J Child …. 2012;6(3):81-84. doi:10.7196/SAJCH.479
2. Zipursky A, Wazny K, Black R, et al. Global action plan for childhood diarrhoea: Developing research priorities: Report from a Workshop of the Programme for Global Paediatric Research. J Glob Health. 2013;3(1):10406. doi:10.7189/jogh.03.010406
3. Lee WS, Poo MI, Nagaraj S. Estimates of economic burden of providing inpatient care in childhood rotavirus gastroenteritis from Malaysia. J Paediatr Child Health. 2007;43(12):818-825. doi:10.1111/j.1440-1754.2007.01160.x
4. Hsu VP, Abdul Rahman H Bin, Wong SL, et al. Estimates of the burden of rotavirus disease in Malaysia. J Infect Dis. 2005;192 Suppl (Suppl 1):S80-6. doi:10.1086/431494
5. Ferrer SR, Strina A, Jesus SR, et al. A hierarchical model for studying risk factors for childhood diarrhoea: a case-control study in a middle-income country. Int J Epidemiol. 2008;37(4):805-815. doi:10.1093/ije/dyn093
6. Gurpreet K, Tee GH, Amal NM, Paramesarvathy R, Karuthan C. Incidence and determinants of acute diarrhoea in Malaysia: a population-based study. J Health Popul Nutr. 2011;29(2):103-112. http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3126982 & tool=pmcentrez & rendertype=abstract.
7. Agustina R, Sari TP, Satroamidjojo S, Bovee-Oudenhoven IMJ, Feskens EJM, Kok FJ. Association of food-hygiene practices and diarrhea prevalence among Indonesian young children from low socioeconomic urban areas. BMC Public Health. 2013;13(1):977. doi:10.1186/1471-2458-13-977
8. Mengistie B, Berhane Y, Worku A. Prevalence of diarrhea and associated risk factors among children under-five years of age in Eastern Ethiopia : A cross-sectional study. Open J Prev Med. 2013;3(7):446-453. doi:10.4236/ojpm.2013.37060
9. Mok TP, Maclean G, Dalziel P. Alternative Poverty Lines for Malaysia. Asian Econ J. 2013;27(1):85-104. doi:10.1111/asej.12003
10. Ntoimo LF, Odimegwu CO. Health effects of single motherhood on children in sub-Saharan Africa: a cross-sectional study. BMC Public Health. 2014;14(1):1145. doi:10.1186/1471-2458-14-1145
11. Tam CC. Fortune and foreigners: Toward an epidemiology of food (borne illness). Epidemiol Cambridge Mass. 2008;19:291-293. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=pubmed & cmd=Retrieve & dopt=AbstractPlus & list_uids=18277166.
12. Choy SH, Al-Mekhlafi HM, Mahdy M a. K, et al. Prevalence and Associated Risk Factors of Giardia Infection among Indigenous Communities in Rural Malaysia. Sci Rep. 2014;4:6909. doi:10.1038/srep06909
13. Shrestha S, Aihara Y, Yoden K, Yamagata Z, Nishida K, Kondo N. Access to improved water and its relationship with diarrhoea in Kathmandu Valley, Nepal: a cross-sectional study. BMJ Open. 2013;3(6):1-8. doi:10.1136/bmjopen-2012-002264
14. Lawson DW, Borgerhoff Mulder M, Ghiselli ME, et al. Ethnicity and Child Health in Northern Tanzania: Maasai Pastoralists Are Disadvantaged Compared to Neighbouring Ethnic Groups. PLoS One. 2014;9(10):e110447. doi:10.1371/journal.pone.0110447
15. Dessalegn M, Kumie A, Tefera W. Predictors of under-five childhood diarrhea: Mecha District, West Gojam, Ethiopia. Ethiop J Heal. 2011;25(3):192-200. http://www.ajol.info/index.php/ejhd/article/view/83811. Accessed October 11, 2013.
16. Farthing M, Salam M a, Lindberg G, et al. Acute diarrhea in adults and children: a global perspective. J Clin Gastroenterol. 2013;47(1):12-20. doi:10.1097/MCG.0b013e31826df662

17. Becker-Dreps S, Zambrana LE, Reyes D, Vilchez S, Weber DJ. Household management of childhood diarrhoea: A population-based study in Nicaragua. J Heal Popul Nutr. 2014;32(1):149-154.
18. Alnawajha SK, Bakry GA, Aljeesh YI. Predictors of Acute Diarrhoea among Hospitalized Children in Gaza Governorates : A Case-Control Study. J Health Popul Nutr. 2015;33(1):1-8.
19. Uwizeye D, Sokoni CH, Kabiru CW. Prevalence and correlates for diarrhoea in the mountainous informal settlements of Huye town, Rwanda. Springerplus. 2014;3(1):745. doi:10.1186/2193-1801-3-745
20. Oloruntoba EO, Folarin TB, Ayede AI. Hygiene and sanitation risk factors of diarrhoeal disease among under-five children in Ibadan, Nigeria. Afr Health Sci. 2014;14(4).
21. Munyuli MT, Kavuvu J-MM, Mulinganya G, Bwinja GM. The Potential Financial Costs of Climate Change on Health of Urban and Rural Citizens: A Case Study of Vibrio cholerae Infections at Bukavu Town, South Kivu Province, Eastern of Democratic Republic of Congo. Iran J Public Health. 2013;42(7):707-725. http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3881617 & tool=pmcentrez & rendertype=abstract.