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PREVALENCE OF DIARRHOEA IN CHILDREN UNDER 5 YEARS OF AGE AND ASSOCIATED FACTORS IN THE PERIURBAN ENVIRONMENT OF THE CITY OF KISANGANI, TSHOPO PROVINCE, DRC.

Basandja LE*[1], Panda LK[1,2] and Losimba LJ[1].

[1]Department of Public Health, Faculty of Medicine and Pharmacy, UNIKIS. B.P. 2012, Kisangani.

[2]School of Public Health, Faculty of Medicine, University of Liege, Belgium

*Corresponding Author

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ABSTRACT

Introduction

This study was conducted to determine the prevalence of diarrhea among children under 5 years of age and the associated factors.

Method

An analytical study was conducted in 190 selected households in two peri-urban Health Zones of the city of Kisangani, during the period of 22-31 December 2019. Using SPSS 20 software, the prevalence of diarrhea in children under 5 years of age was determined, multivariate analysis of factors associated with diarrhea was performed by adjusted ORs derived from a top-down stepwise logistic regression model and WALD Chi-square at the 5% significance level.

Results

The overall prevalence of diarrhoea was 4.5% (CI95: 4%-5%), about three times higher in children under 5 years of age (13% CI95: 10%-16%). No difference in prevalence with unsanitized villages (p>0.05);
Household water treatment (aOR=0.07; CI95 =0.015-0.366) and use of improved toilets (aOR=0.157 CI95=0.031-0.79) protect against diarrhoea; water storage time of 48 hours or more increases the risk of diarrhoea about 7.5 times (aOR=7.39; CI95 =3.16-17.3).

Conclusion

Household prevalence of diarrhoea among children under five years of age remains high. Reducing water storage time to 24 hours, home water treatment and hygienic excreta disposal are essential actions to promote.

KEYWORDS: Diarrhea, Children under 5, risk factors, Kisangani, DRC

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1. INTRODUCTION

Diarrhea is one of the most common and widespread diseases in the world. In 2013, the World Health Organization defined acute diarrhea as the emission of three or more loose or watery stools per day (or the emission too frequently than is usual for the affected individual) [1].

It is one of the leading causes of child mortality and morbidity in the world, and is most often the result of contaminated water or food. Globally, approximately 780 million people lack access to safe water and 2.5 billion lack access to basic sanitation [1].

According to WHO statistics, diarrhoea ranks high among the causes of death and disease, claiming 1.8 million lives and causing an estimated 4 billion episodes of illness each year. Children are most at risk from diarrhoea, with each episode reducing their caloric and nutrient intake, stunting their growth and development. 90% of diarrhoeal deaths occur in children under 5 years of age, mainly in developing countries [2, 3].

In 2012, it was estimated that 502,000 deaths from diarrhea were caused by lack of safe drinking water [4]. Unhygienic water storage and handling practices were strongly correlated with microbial contamination of water samples [5].

They are the leading cause of infant mortality in developing countries and cause major morbidity before the age of five.

Factors associated with childhood diarrhea and contamination of drinking water in households are well documented. In Cambodia it was found that unhygienic water storage and handling practices were strongly correlated with microbial contamination of water samples [5]. In Canada [6] and Peru [7], households that accessed water by dipping hands or cup had significantly higher numbers of Escherichia coli compared to households that extracted water by pouring; also, households with covered containers less than those with open containers.

In sub-Saharan Africa, childhood diarrhoea is a public health problem. These diarrhoeal diseases have an economic impact that is all the greater because they preferentially affect the most disadvantaged countries [1]. They are linked to the proliferation of enteropathogenic germs, conditions linked to the lack or insufficiency of hygiene measures, poverty and malnutrition. The transmission of these germs is favoured not only by the conditions of the physical environment, but also and above all by the non-respect of hygiene measures, the insufficiency or malfunctioning of sanitary infrastructures and collective equipment

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intended for the evacuation and treatment of waste water, the insufficient supply of drinking water to households, etc. [8, 9].

In Abidjan, Côte d'Ivoire, the place of storage, the type of water storage containers and certain risk behaviours (child eating without washing hands) were identified as factors associated with diarrhoea. Also, the large volume of water and the absence of a lid were associated with contamination of water at home [10].

Other factors associated with diarrhea identified were low level of education of mothers, unfavorable behaviors related to fecal disposal practices, especially of children, poor quality of drinking water (traditional water points), insufficient practice of hand hygiene and lack of water treatment at home [2, 5, 8, 11-14].

In the DRC, 17% of children under five years of age suffered from diarrhoea during the two weeks preceding the interview, this prevalence was 13.4% in Orientale province [15]. In a recent study conducted in DRC in South Kivu, a higher prevalence (18.8%) was found [16].

A systematic review in 2005 concluded that diarrhoeal episodes were reduced by 25% when water supply was improved and by 39% through home water treatment and conservation [17].

WHO estimates that 94% of diarrhoeal episodes are preventable through environmental change, including interventions to increase the availability of clean water and improve hygiene and sanitation [17]. Properly treating and storing water at home would clearly accelerate progress towards the MDGs (target 10) in situations where families have access to sufficient quantities of water but where the quality is poor or questionable [18].

The health and economic impact of diarrhoeal diseases requires prevention and management strategies in both developing and industrialized countries.

In view of the absence of local data on the prevalence of diarrhoea in children under 5 years of age in the coverage area of a water supply programme and the contextual lack of information on associated factors, especially since habits, practices and the distribution of risk factors are not superimposable, this study was conducted in the peri-urban part of the city of Kisangani to determine the prevalence of diarrhoea in children under 59 months of age and the associated factors.

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II. MATERIALS AND METHOD

Study framework

This study was conducted in two peri-urban ZS of the city of Kisangani, the ZS of LUBUNGA and WANIERUKULA, drawn in a simple random way among ten (10) ZS having obtained the certification of some villages between 2014 and 2017, within the framework of the National Programme Ecole et Village Assainis (PNEVA) in the Tshopo province of the DRC.

Study period

The data collection had taken place from 22 to 31 December 2019.

Type of study

An analytical study was conducted to determine the prevalence of diarrhea among children under 5 years of age in households and to investigate associated factors.

Sampling

The sample size of households to be surveyed was calculated according to the formula:

$$n = Z^{2*}pq/d^2$$

Considering the prevalence of diarrhea in children under 5 years of age as the main indicator of this study, estimated at 13.4% in Province Orientale (DHS-DRC, 2013-2014), with the coefficient Z=1.96, the degree of error at 0.05 and an anticipated non-response rate of 10%, the calculated sample size was 196 households.

We proceeded by complex cascade sampling as follows:

(i) Simple random selection of two Health Zones (HZ);
(ii) Stratification of the health areas drawn into health areas with sanitized villages (HASV) and health areas with unsanitized villages (HAUSV);
(iii) Simple random selection of three (3) health areas from the HASV category and two (2) health areas from the HAUSV category;
(iv) Drawing of the two clusters (villages) per selected HA;
(v) Selection of households in the villages drawn by the systematic sampling technique after the household survey.

A total of 190 households were selected from 20 villages in 10 HA in two HZ. Eligible households were those with at least one child under the age of 5 years.

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Data collection

Data were collected using a guided interview technique with a structured questionnaire, supplemented by direct observation of water storage containers and types of toilets used by the households.

Operational definition of concepts

National Programme for Sanitized Schools and Villages: This is a Congolese government programme that aims to combat water-borne and vector-borne diseases by improving access to drinking water through the development of springs and the digging of wells and boreholes, the use of improved latrines, the maintenance of the cleanliness of the immediate environment of the dwelling, and the adoption of the correct practice of hand washing with a detergent (soap) at critical moments [19, 20].

Sanitized village: is a village integrated in the sanitation program with active participation of the local population through a dynamic sanitation committee, having a coverage of at least 80% of improved water points and hygienic latrines and at least 65% of households having hand washing facilities [21].

Description of variables of interest

The independent variables analyzed were: educational level of mothers, level of knowledge of water-related health risk, duration of water storage, main source of water supply, exclusive use of an improved source, home water treatment, type of toilets used, techniques for disposing of children's feces, types of storage containers, and water collection technique.

Statistical analysis

The collected data were encoded and analyzed using SPSS 20 and Excel software. The tables were exported to Excel for formatting.

The association between the occurrence of diarrhea and the different explanatory variables of interest was investigated using Pearson's Chi2 and the strength of association was estimated using ORs.

Finally, to account for potential confounding factors, a logistic regression model was developed taking into account all explanatory variables significantly associated with the occurrence of diarrhea ($p<0.05$). All variables were dichotomized, the adjusted OR derived from the model was presented as well as the p-value of the WALD chi2.

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The adequacy of the model was verified using the STATA "goodness of bed" test by considering the classification very satisfactory (>= 80%) and satisfactory between 70 and 80%. The fit of the data to the model was evaluated using the Hosmer and Lemeshow test.

Ethical considerations

The research protocol had received the favorable opinion of the ethics committee of the University of Kisangani and research authorizations from the Faculty of Medicine and Pharmacy, the Provincial Health Division of Tshopo, and the central offices of the Health Zones.

Information about data collection was clearly presented to respondents, and written consent was obtained from all participants. All data collected were treated as anonymous.

III. RESULTS

Prevalence of diarrhoea in households (Table 1)

Description of the sample	Sanitized villages	Non-integrated villages	Set
	Frequency [95 CI]	Frequency [95 CI]	Frequency [95 CI]
Number of households	114	76	190
Number of people	1193	887	2080
Number of children under 5 years old	267	220	487
Number of households with at least one case of diarrhea	34	25	59
Number of people with diarrhea	55	38	93
Proportion of households with at least one case of diarrhea	29,8% [21-38]	32,9% [22-44]	31,1% [24-38]
Number of children under 5 with diarrhea	34	30	64
Overall prevalence of diarrhea (p>0.05)	4,6% [3-6]	4,3% [3-6]	4,5% [4-5]
Prevalence of diarrhea in children under 5 years of age	12,7% [9-17]	13,6% [9-18]	13,1% [10-16]

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About 1/3 of households had experienced diarrhea in the two weeks prior to the survey (31%). The overall and specific prevalence of diarrhea among children under 5 years of age was identical between the two village categories; this prevalence was about three times higher among children than among the total household population, respectively 13.1% (CI95: 10%-16%) and 4.5% (CI95: 4%-5%).

Bivariate analysis of factors associated with diarrhea in households (Table 2)

	Presence of diarrhea in the household				
education level	**YES N=59**	**NO N=130**	**f (%)**	**OR (95 IC)**	**p-value Mother's**
None and primary	33 (56)	61 (47)		1,4 (0,77-2,67)	0,252
Secondary and Higher Education	26 (44)	69 (53)			
General level of knowledge of water-related health risks				**OR (95 IC)**	p-value
Low	3 (5)	8 (6)		0,82 (0,21-3,20)	0,771
Good	56 (95)	122 (94)			
Water Storage time				**OR (95 IC)**	p-value
24 hours	8 (14)	68 (52)			0,000
48 hours or more	51 (86)	62 (48)		0,14 (0,06-0,33)	
Main source of water supply				**OR (95 IC)**	p-value
Unimproved	46 (78)	103 (79)		1,08 (0,51-2,28)	0,844
Improved	13 (22)	27 (21)			
Exclusive use of an improved source				**OR (95 IC)**	p-value
No	13 (22)	52 (40)		2,36 (1,16-4,79)	0,018
Yes	46 (78)	78 (60)			
Home water treatment				**OR (95 IC)**	
No	2 (4)	30 (23)		0,12 (0,03-0,51)	0,004
Yes	57 (96)	100 (77)			
Category of toilet types				**OR (95 IC)**	p-value
Not Improved	51 (86)	127 (98)		0,151 (0,038-0,59)	0,007
Improved	8 (14)	3 (2)			
Technique for the disposal of children's faeces				**OR (95 IC)**	p-value

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Not hygienic*.	31 (53)	62 (48)	1,21 (0,66-2,25)	0,537
Hygienic	28 (47)	68 (52)		

(*) Disposal on the ground and in any way.

Table 2 shows that 24-hour water storage and less (OR=0.14; CI 95: 0.06-0.33), exclusive use of an improved source (OR=2.36; CI 95: 1.16-4.79), home water treatment (OR=0.12; CI 95: 0.03-0.51) and use of improved toilets (OR=0.151: CI 95: 0.04-0.59) were significantly associated with diarrhea.

Logistic regression of factors associated with diarrhea in households (Table 3)

Variables	**Parameters**	**N=59 n (%)**	**p-value**	**aOR**	**IC95**
Water treatment at home	Yes	13 (22)	0,001	0,070	(0,015 - 0,37)
	No	46 (78)			
Water storage time	48 hours and more	51 (86)	0,000	7,39	(3,16 - 17,3)
	24 hours	8 (14)			
Toilet category	Unimproved	50 (85)	0,028	1,141	(1,02 - 1,96)
	Improved	9 (15)			

Table 3 shows that home water treatment (aOR=0.07; CI95 =0.015-0.37) protects against diarrhoea; use of unimproved toilets (aOR=1.141; CI95=1.02-1.96) promotes diarrhoea; and water storage time of 48 hours or more increases the risk of diarrhoea about 7.5 times (aOR=7.39; CI95 =3.16-17.3).

IV. DISCUSSION

The proportion of households with diarrhoea in the two weeks preceding the survey was 31.1%; the overall prevalence of diarrhoea was 4.5% (CI95: 4%-5%) and 13% (CI95: 10%-16%) among children under 5. No difference was observed between sanitized and unsanitized villages (p>0.05) (Table 1).

The overall prevalence of diarrhea observed in this study was low (4.5% IC95: 4%-5%) compared to what was observed in Nigeria (21%) [22], Mauritania (10%) [14] and Côte d'Ivoire (7%) [23]. Our study was conducted in an intervention zone that has the necessary assets to deal with diarrhea, notably the presence of rehabilitated structures. On the other hand, the study conducted in the three other countries were in the general population.

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However, the prevalence among children under 5 years of age was comparable (13% CI95 : 10%16%) to that found in Mauritania (13.5%) [14], Côte d'Ivoire (14%) [23], Cameroon (15%) [24] and Senegal (15.5%) [25]. The higher prevalence in children under 5 years of age was found in Senegal in another more recent study (26%) [26]. This high prevalence was justified by the lack of general sanitation measures and the problem related to household behaviours regarding the management of faces, especially of children, in the neighborhood where the study was conducted.

Treating water at home (aOR=0.07; CI95 =0.015-0.366) and using improved toilets (aOR=0.157; CI95=0.031-0.79) were protective against diarrhea. In contrast, water storage time of 48 hours or more increased the risk of contracting diarrhea about 7.5 times (aOR=7.39; CI95=3.16-17.3) (Tables 2 and 3). These factors are consistent with observations made in other research. In a study conducted in Mauritania, water storage was the stage of the supply cycle associated with high water contamination; the contamination rate varied from 56.3% to 85.4% and was 70% for the storage stage. Storage time of 48 hours, type of containers and less hygienic handling were the most frequent causes [27]. This corroborates the results of our study for water storage time.

In another study, water storage for 48 hours or more was associated with diarrhea in 65% of cases [14]. In Nigeria, the absence or poor practice of hand hygiene after washing children was associated with diarrhea [28]. In Cameroon, sanitation practices concerning faeces [24], in Cote d'Ivoire [14]. In Cameroon, the location of drinking water storage, the type of water storage containers and the location of latrine facilities were associated with diarrhoea in children [28]. In Senegal, behavioural factors and sanitation were selected [25].

In Afghanistan, the use of improved toilets was identified as a protective factor against diarrhoea among children under 5 years of age in households, which is consistent with the results of our study [29].

A systematic review conducted in developing countries and the one conducted in Senegal, emphasize point-of-use water treatment as one of the proven effective interventions to improve water quality [2, 13]. This study, like others elsewhere, has highlighted the limitations of improving water supply as an indicator of access to safe water. Less hygienic household water management, prolonged storage of drinking water and limited access to sanitation, mainly unhygienic faecal disposal and lack of hand hygiene after washing, are factors to be taken into account as a mandatory complement in PNEVA coverage areas to effectively combat diarrhoeal diseases.

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The lack of difference in diarrhea prevalence and practices between sanitized and unsanitized villages is strong evidence of the loss of certification status of the villages. The variables significantly related to the presence of diarrhea after adjustment merit attention to their prevention.

CONCLUSION

The prevalence of diarrhoeal disease remains high, about three times higher in children under five. Water storage of up to 24 hours protects against diarrhoea, but inadequate water treatment and unsanitary faecal disposal promote diarrhoea.

In view of these facts, other complementary measures are indispensable in the coverage area of water supply programmes, if we hope to meet the MDGs by 2030, notably the reduction of water storage time to 24 hours, the hygienic disposal of faeces and the treatment of water from unimproved water points.

Conflict of interest

No

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