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COMMUNITY SURVEY OF DIARRHOEA IN CHILDREN UNDER 5 YEARS IN KINSHASA, ZAIRE

by

M.-C. HENRY[1], M. ALARY[2], P. DESMET[1], M. GERNIERS[3],
D. MUTETEKE[1], I. NKU[3], L. MUTOMBO[4] & P. PIOT[2]

[1] *Unit of Parasitology/ITM, Faculty of Medicine, UNIKIN, Kinshasa, Zaire*
[2] *Laboratory of Microbiology, Institute of Tropical Medicine, Antwerp, Belgium*
[3] *Projet Santé pour Tous, Kinshasa, Zaire*
[4] *Programme Elargi de Vaccination, Ministry of Health, Kinshasa, Zaire*

Summary – This community based survey was undertaken to assess the prevalence, characteristics and risk factors of diarrhoea in children < 5 years of age in an urban zone, at Kinshasa, Zaire. 155 community cases selected by cluster sampling, 155 age-matched controls, and 18 children with diarrhoea seen at a health centre (HC) were examined. The diarrhoea prevalence rate was 6.5%. The highest risk of persistent diarrhoea was in children of 2 to 3 years, non breast-fed, with more than one enteric agent in their stools and living in households without electricity. The rates of detection of *Strongyloides stercoralis, Entamoeba histolytica* and *Salmonella,* and heavy infections of *Trichuris trichiura* and *Trichomonas hominis* were significantly higher in cases ($p < 0.05$). The rate of detection of *Cryptosporidium* was rather high, specially in HC cases (22.2%). It was also found in both diarrhoeal (14.8%) and non-diarrhoeal specimens (12.9%). There was a lack of association between the presence of faecal white blood cells and enteric bacteria, and also between the presence of faecal red blood cells and E. *histolytica,* which might be due to the frequent practice of rectal injections and suppositories. A mother's perception of fever and stool aspect was fairly in agreement (respectively 70% and 53%) with that of the investigators. The high rate of dehydrated children (50.9%) may be due to the dehydration definition applied at the HC. The survey's results were used to improve the local case management flow chart and to adjust educational activities directed at mothers.

Keywords: Diarrhoea; Children under 5; Community Survey; Epidemiology; Aetiology; Public Health; Zaire.

Introduction

Diarrhoeal disease continues to be a major public health problem in most developing countries. From studies in Africa, Latin America and Asia (excluding China), the estimated median annual morbidity and mortality rates were 2.2 episodes per child per year and 13.6 deaths/1000 population for children under 5 years old, respectively (13).

In Zaire a few studies were published on diarrhoeal illness in children (8, 12). All were hospital-based and were aimed at aetiological investigation. The present survey which was community-based was carried out in order to better assess diarrhoeal disease in an urban zone of Kinshasa and to improve the practical approach to diagnosis and management of diarrhoeal illness. Besides investigations of the aetiology of diarrhoea, the prevalence and typi-

Address for correspondence: Dr. Marie-Claire Henry, Institut P. Richet/OCCGE, BP 1500, Bouaké 01, Côte d'Ivoire.

cal features of diarrhoea were determined; the socio-economic status of households in relation to diarrhoea was evaluated and the mother's perception of diarrhoea was assessed.

Material and methods

The health zone Elonga (20,000 inhabitants) which is part of the administrative Zone Masina in the city of Kinshasa was chosen for the study because of available demographic data and its accurate geographical boundaries. It is served by one health centre (HC). A cluster sampling method was used in this survey conducted in 1990 for 6 weeks during the rainy season. From a randomly selected starting point, one of every 2 households in Elonga was systematically visited. In each household a team of 2 trained investigators including a nurse and a laboratory technician recorded the total number of children under 5, as well as the number of children with diarrhoea. Diarrhoea was defined as the emission of at least 3 liquid or semi-liquid stools per day (17). All the diarrhoeal children under 5 in a household were enrolled in the study. The mother or another responsible adult was asked about duration of diarrhoea, the number of stools per day, stool aspect, feeding practices, dehydration signs, fever and therapy of the child. The presence of electricity, water supply and latrine was also recorded. In addition the team members examined the children for signs of dehydration and fever. Dehydration was defined as one of 5 physical examination signs including persistent skin fold, sunken eyes, dry mouth and tongue, sunken fontanelle and increased thirst. For each diarrhoeal case, an age-matched non-diarrhoeal control was sought in the neighbouring homes not taking part in the survey. Non-diarrhoeal children had < 3 stools per day for at least 4 days. Socio-economic variables were also recorded in control children. Moreover all children from the health zone, who attended the HC for diarrhoea. were similarly observed.

Sample collection and laboratory analysis.

During the visit, proceeding only in the morning, stools were collected in both a pipette from the anus and in a test tube, and non-diarrhoea stools only in a test tube. When a specimen could not be obtained for the test tube, the mother was asked to collect it the next morning. Every morning two people collected the fecal samples taking them within 2 hours of collection to the HC under refrigerated conditions. The parasitology investigations were performed upon receipt. The stool aspect (colour, consistency, presence of blood, mucus, worms) was first determined. Then the parasites were detected by the direct examination of saline preparations; eosine preparations were used to differentiate the cysts of protozoa. All faecal examinations (of which 10 % were reexamined by the supervisor) were performed by the same technician. The direct examination may be considered as a semi-qualitative method, assuming a stool quantity of about 2 mg per saline preparation (14). Infections were considered to be heavy when over 100 *Ascaris lumbricoïdes* eggs or 20 *Trichuris trichiura* eggs were counted in the whole saline preparation. These load thresholds approximate to loads of over 50,000 *A. lumbricoïdes* eggs per gram of stool (EPG) or 10,000 *T. trichiura* EPG, which arbitrarily define a heavy infection (16). The haemoglobin level was not measured in the children, thus

Ankylostoma duodenale/Necator americanus infection was considered heavy when a count of over 9 eggs was found in the whole saline preparation, assuming a load of over 4,500 hookworm EPG (16). Infections of *Giardia* and *Trichomonas hominis* were considered heavy when there were more than 20 protozoa/field in at least 10 fields (X10 obj, X10 eye piece).

Early in the afternoon all specimens were brought to the laboratory of Parasitology, under refrigerated conditions. A part of the stool specimens was immediately examined for bacteria. To identify *Salmonella, Shigella, Yersinia enterolotica, Campylobacter jejuni* and enteropathogenic *Escherichia coli,* specimens were inoculated directly on selective *Salmonella, Shigella* and *Y. enterolitica* media, as well as after enrichment on sodium selenite medium. All suspect colonies underwent a screening by the following tests: Kigler, indole, citrate, ONPG, lysine decarboxylase. Positive colonies on screening were further identified by conventional biochemical and enzymatic parameters. Colonies of *E. coli* isolated from Mac Conkey agar were plated on Trypticase Soy Agar for agglutination with polyvalent *E. coli* antiserum (Oxoid). Selective Columbia blood agar (Butzler-Oxoid) was used for isolation of C. *jejuni.* The plates were incubated at 40°C. in an anaerobic jar and read after 40 hrs. Suspect colonies were gram stained and tested for motility as well as oxidase production. The isolated *E. coli* and *Salmonella* strains inoculated onto transport medium (T.S.A.) were sent to the laboratory of Microbiology in Antwerp for confirmation. The different serotypes of *Salmonella* strains were identified with antisera of Wellcome (Wellcome -Diagnostics, England). *E. coli* isolates were serotyped to identify conventional enteropathogenic serotypes (Difco Laboratories, US) at the University of Leuven/ Belgium. The same afternoon, the other part of stool specimens was concentrated by sedimentation (4). The upper layer of sediment was placed on a slide and then stained by modified Kinyoun coloration to identify *Cryptosporidium* and I. *belli* (4). The rest of the faecal sediments was kept at 4°C. Within the week *Rotavirus* and *Adenovirus* detections were carried out on the sedimented material kept at 4°C., by a latex agglutination method using Slide Rota Kit 2 (Bio-Mérieux, France) and Adenolex Kit (Orion Diagnostica, Finland), respectively.

Statistical analysis

The X^2 test and the Fisher test were used to compare proportions. The Students' t test allowed the comparison of means. To analyze differences between community cases and controls, the odds ratio (OR) was used as the measure of association in a matched analysis.

Results

A total of 1,411 households were visited and 2,644 children under 5 years were identified of whom 172 had diarrhoea. In contrast, during the survey period only 18 children under 5 years from the health zone attended the HC for diarrhoea. Among 172 diarrhoeal children, data were omitted in 14 cases and were not obtained from 3 other patients. Therefore a total of 328 children entered into the study: 155 community cases (172-17) plus 155 controls plus 18 HC cases.

Characteristics of children with diarrhoea

The prevalence rate of diarrhoea was 6.5% (172/2,644). Most diarrhoea cases were younger than 2 years (59.5%). The mean number of stools per day (5,15) was similar in community cases and in HC cases. The mean duration of an episode was 8.53 days. Thirty four (19.7%) cases were reported lasting 14 and more days. The rate of persistent diarrhoea increased with age (χ^2 for trend, p = 0.03) (Figure 1). Moreover non breast-fed children experienced a longer diarrhoea (10.2 days vs. 6.3 days, p = 0.01), and had persistent diarrhoea more often (p = 0.01) than breast-fed children. However, the association between breast-feeding and duration of diarrhoea was not observed in age-specific analyses. Indeed, younger infants were almost always breast-fed whereas older ones were rarely breast-fed (Table 1). The duration of diarrhoea was longer in HC cases than in community cases (13.7 days vs. 7.9 days; p = 0.03).

Figure 1: Diarrhoea duration in children (155 community cases + 18 HC cases) in relation to age

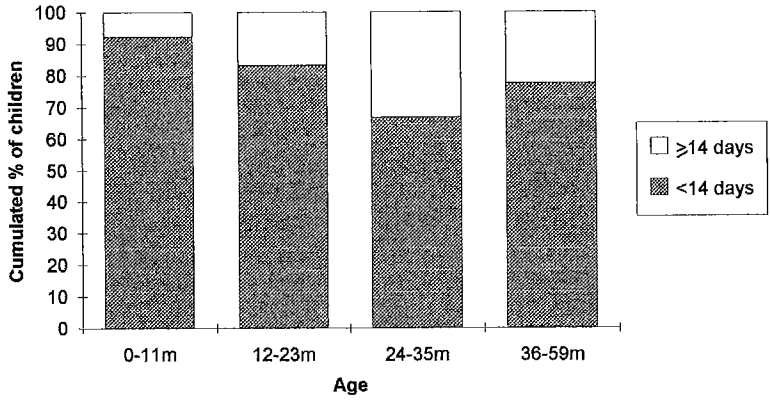

TABLE 1

Diarrhoea duration in relation to age and feeding practices.

Age	0-11 m		12-23 m		24-35 m		36-59 m		Total*	
Feeding practices	*BF* (%)*	*NBF** (%)*	*BF (%)*	*NBF (%)*	*BF (%)*	*NBF (%)*	*BF (%)*	*NBF (%)*	*BF (%)*	*NBF (%)*
Duration of diarrhoea										
< 14days	*35 (92.1)*	*0*	*34 (87.2)*	*19 (79.2)*	*2 (66.7)*	*24 (66.7)*	*0*	*24 (77.4)*	*71 (88.8)*	*67 (83.6)*
≥ 14 days	*3 (7.9)*	*0*	*5 (12.8)*	*5 (20.8)*	*1 (33.3)*	*12 (33.3)*	*0*	*7 (22.6)*	*9 (11.2)*	*24 (26.4)*

** Breast-feeding.*
*** Non breast-feeding.*
** There were two missing values on breast-feeding. Overall, breast-fed children had a lower proportion of persistent (≥ 14 days) diarrhoea than the others (p = 0.01, chi-square).*

Risks factors associated to diarrhoea and to specific agents

By using the odds ratio, we have observed a similar distribution of the feeding practices (breast-feeding and non breast-feeding) between the commu-

nity cases and the controls. The proportion of diarrhoeal children was higher in the households without any utility (including electricity. water supply and latrine) (OR = 2.2, χ^2 = 4.1 p = 0.04). The children of those households were also more often infected with *A. lumbricoïdes, A. duodenale/N. americanus* or *Cryptosporidium* (p < 0.05). The children from the households with water supply and latrine but without electricity were more often infected by nematoda and a greater number of enteric agents (p = 0.05), while the children from the households with electricity and water supply but without latrine more often had *A. lumbricoïdes* in their stools (p = 0.02).

Aetiology

TABLE 2

Enteric agents in stools of children in Kinshasa, Zaire, February-March 1990

	CHILDREN WITH DIARRHOEA		
	Health centre cases *n = 18* *(%)*	*Community cases* *n = 155* *(%)*	*Controls* *n = 155* *(%)*
Ascaris lumbricoïdes			
Presence	1 (5.5)	27 (17.4)	32 (20.6)
Heavy load	0	3 (1.9)	1 (0.6)
Trichuris trichiura			
Presence	7 (38.9)	34 (21.9)	37 (23.9)
Heavy load *	1 (5.5)	6 (3.9)	0
Ankylostoma duodenale, *Necator americanus*			
Presence	0	11 (7.1)	3 (1.9)
Heavy load	0	2 (1.3)	0
Strongyloïdes stercoralis *	3 (16.7)	14 (9.0)	3 (1.9)
Entamoeba hystolitica *	0	7 (4.5)	0
Giardia lamblia			
Presence	1 (5.5)	18 (11.6)	19 (12.3)
Heavy load	0	5 (3.2)	6 (3.9)
Trichomonas hominis			
Presence	5 (27.8)	11 (7.1)	2 (1.3)
Heavy load *	2 (11.1)	4 (2.6)	0
Isospora belli	2 (11.1)	5 (3.2)	2 (1.3)
Cryptosporidium	4 (22.2)	23 (14.8)	20 (12.9)
Salmonella *	1 (5.5)	5 (3.2)	0
EPEC	2 (11.1)	10 (6.5)	9 (5.8)
Campylobacter jejuni	0	1 (0.6)	0
Adenovirus types	4 (22.2)	22 (14.2)	20 (12.9)
Rotavirus	0	2 (1.3)	2 (1.3)

*: significant difference between community cases and controls, p < 0.05

The distribution of the enteric agents in the stool of children is shown in Table 2. The proportion of diarrhoeal children with one or more bacterial, viral or parasitic enteric agents was higher than in controls (p = 0.03). *S. stercoralis, E. histolytica, Salmonella* and heavy infections of *T. trichiura* and *T. hominis* were detected more frequently in community cases than in controls (p < 0.05). Among the 5 *Salmonella* strains, *S. typhi murium* was isolated twice and *Salmonella* group B, S. *agona* and *Salmonella* group D, once each. All *E. coli* pathogens were serotyped EPEC. They were equally detected in cases and in controls. *Shigella* and *Y. enterocolitica* were not isolated. The rate of detection of *Crypstosporidium* was quite high, specially in HC cases (22.2 %). By considering all 328 children the proportion of children in whom no diar-

rhoea-associated agent was identified, was higher in the group under 2 years (97/197 vs. 25/131, $p < 0.01$). Moreover, persistent diarrhoea was more frequent in children with more than one enteric agent in their stool ($p = 0.03$). They were also more frequently dehydrated than other cases ($p = 0.02$).

There was no relationship between white blood cells (WBC) in stool and enteric bacteria, nor between red blood cells (RBC) in stool and *E. histolytica.* Macroscopic blood in diarrhoeal stools was associated with *E. histolytica* ($p = 0.04$). There was no correlation between tube and pipette examinations for the presence or lack of WBC and RBC in stool. *E. histolytica* was the only parasite found more often in pipette samples. with 2 cases both in pipette and tube specimens and 5 times only in the pipette specimen. Only trophozoïtes of *E. histolityca* were observed in the stools.

Mother's perception and case management

Mother's perception of the aspect of diarrhoeal stools was similar to that of the investigators in 53.7 % cases (79/149). Moreover there were not many cases considered as diarrhoea by the mother and in which the investigators found a solid stool (Table 3). However as far as blood, mucus or worm presence in stool was concerned, there were many discrepancies between the mother's opinion and the investigators'.

TABLE 3

Stool aspect in diarrhoeal children according to the mothers and the investigators

	INVESTIGATOR'S ASSESSMENT				
Mother's assessment	solid	semi-liquid	liquid	aqueous	not determined
Solid	0	0	0	0	0
Semi-liquid	4	52	24	1	3
Liquid	3	35	26	1	3
Aqueous	0	0	2	1	1
Not determined	1	11	4	0	1

According to the investigators, 50.9 % (88/173) of diarrhoeal children were dehydrated. When the mothers were asked whether their child was dehydrated, 82 % expressed no opinion. After reminding the mothers of dehydration signs, 58.9 % could identify at least one sign of dehydration. Their opinion was similar in 45 % of cases to that of the investigators.

The mother's perception of fever was similar to that of investigators in 70,5 % of cases.

Before the investigators' visit or before attendance at the HC, 56.6 % of children had received a treatment against diarrhoea, including 45.1 % at home, 8.1 % at a dispensary and 3.4 % at both sites. Among those treated, therapy included traditional treatment (21.5 %), oral rehydration solution (24.3 %), antibiotics (24.3 %), antidiarrhoeal remedies (19.6 %), antiparasitic drugs (17.8 %) and local medication (35.5 %). Children dehydrated according to investigators had more often received some treatment than the other children ($p = 0.02$).

Discussion

The prevalence rate of diarrhoea (6.5 %) was lower in Elonga than in other African surveys using a similar design, such as in Nigeria and in Mozambique, where rates ranged between 15 and 50 % (7) and 13.1 % (6), respectively. The prevalence rate is difficult to interpret. It only gives a point picture of the diarrhoeal situation in a site, as diarrhoeal illness is a repeating phenomenon with episodes due to many varying causes, e.g. infection, feeding practices, etc., of which certain may present seasonal variations.

Participation in our survey was satisfactory, only 3 refusals to give stool samples were recorded. Surprisingly, only 18 children attended the HC for diarrhoea whereas 172 children seen at home had diarrhoea. Families preferred to treat diarrhoea at home (48.5 % of diarrhoeal cases) because of treatment cost at the HC, and sent their children to the HC only when diarrhoea persisted, as suggested by the average duration of disease among children presenting at the HC. In addition because of the eccentric location of the HC in Elonga, several people went to a dispensary nearby. A lower socioeconomic status of households was obviously a risk factor associated with diarrhoea.

The risk for persistent diarrhoea in Elonga increased with age, though the highest risk was experienced by children of 2 to 3 years. Usually young children, specially < 12 months, are more vulnerable (10). This age specific distribution in Elonga might be related to feeding pattern as only 4.6 % of children > 2 years versus 76.3 % of younger children were breast-fed. In our study, breast-feeding seemed to protect children against diarrhoea of long duration and this could be the explanation for the increased risk of persistent diarrhoea with older age that we observed. However matching for age that was used in the case-control study may have masked the association between breast-feeding and diarrhoea per se, as this matching has forced the distribution of breast-feeding to be similar in cases and controls. Therefore it is not clear whether the risk of developing persistent diarrhoea is related to pre-illness feeding patterns. The evidence of this relationship is not shown in other studies (17). Another explanation for the increased risk of persistent diarrhoea in children of 2 years in Elonga could be the presence of more than one enteric agent in their stool, as such a presence during the acute phase may induce a diarrhoea of long duration (17). This is supported by the present study. Furthermore the presence of more than one enteric agent was associated with households without electricity. Finally, the frequency of persistent diarrhoea is found to be increased with the use of antimicrobial, antidiarrhoeic or antiparasitic drugs (Fisher's exact test, $p = 0.04$). It has been postulated that ineffective peristalsis following the administration of antimotility drugs or inappropriate use of antibiotics may favour the overgrowth of pathogenic or commensal bacteria, leading to malabsorption and persistent diarrhoea. Nevertheless the early use of such drugs apart from antiparasitic drugs is not shown to be related to the risk of development of persistent diarrhoea (17).

The proportion of community cases with potential enteric pathogens was higher than that of controls ($p < 0.01$). Of all potential pathogens, parasites were most often associated with diarrhoea. Indeed *E. histolytica, S. stercoralis,* heavy loads of *T. trichiuris* and *T. hominis* were more often identified in community cases than in controls (Table 2; $p < 0.05$). Whereas the egg-load was also shown in Nigeria to be heavier among diarrhoeal groups than in non-diarrhoeal groups of children (1), the number of community cases infected by

a heavy load of *A. lumbricoïdes* and of *A. duodenale/N. americanus* in our study was too low to assess their significance. Heavy or light infections of *G. lamblia* were found in community cases as well as in controls and only giardia cysts were identified. Reasons for asymptomatic giardia infections have still to be clarified (5). *Cryptosporidium,* also found in both diarrhoeal (14,8 %) and non-diarrhoeal specimens (12,9 %) is increasingly recognised not only in immunocompetent and immunocompromised patients (3, 9) but also asymptomatic children (15). Moreover no child from Elonga submitted to the HIV serosurvey in 1988 was found HIV (+) (I. Nku, pers. communication). It suggests that *Cryptosporidium* and I. *belli* infections observed in our study were not probably linked with AIDS. Except for *Salmonella* species, the isolation rates of other enteropathogens were not significantly higher in the diarrhoea group. EPEC were most often isolated in children under 2 years old. Contrary to expectation, the rate of *Rotavirus* infections was low (1.2 %) and similar in community cases and in controls. All cases were found in children under 2 years. According to Guerrant et al. (5), rates of *Rotavirus* infections can vary between 5-45 % in diarrhoeal patients from developing areas. Moreover, another Zairian study showed a high rate of *Rotavirus* infection of 42 % in Kinshasa, by using ELISA tests (8). As reported in Ghana (11), the low rate observed in our study may be due to a lower sensitivity of the latex agglutination test to detect all five serotypes of *Rotavirus.*

For a practical approach to the case management of diarrhoeal illness, specially at the HC where bacterial investigations are not possible, identification of faecal WBC and RBC is often recommended. Neither the presence of faecal leukocytes, nor the presence of faecal RBC could be used to identify inflammatory type diarrhoea or amoebiasis, respectively. This may be due to the frequent local practice of rectal injections and suppositories resulting in damaged anal mucous membranes and the presence of WBC and RBC in stool. On the other hand except for confirming an amoebiasis suggested by the presence of macroscopic blood in liquid stools, a parasitological examination was more sensitive in stools collected in a test tube than in a pipette.

The mother's perceptions of stool aspect and fever in diarrhoeal children, but not of blood and/or mucus in stools, were found to be reliable. Moreover an education campaign on oral rehydration therapy (ORT) carried out in Elonga for 1 year had some effect since 18 % of mothers were able to recognise dehydration in children and nearly 60 % of them after being reminded of signs. 24.5 % of diarrhoeal children were given ORT although it was not always correctly made and often associated with other treatments. Rates of utilization of ORT were reported as remaining below 20 % throughout Bangladesh in spite of a high level of knowledge of mothers (2).

The prevalence of dehydration among diarrhoeal children (50.9 %) was probably overestimated by field workers although they had been trained in a standardized physical examination technique. When using only one of three objective indicators, sunken fontanelle, dry mouth and tongue and persistent skin fold, the rate of dehydration decreased to 12.5 %. In a survey, Herman et al. (6) showed that the rate of 49.6 % of dehydrated children following the definition derived from the WHO treatment chart decreased to 9.9 % by applying their "PE9" definition.

In conclusion the assessment of diarrhoeal illness in an urban zone of Kinshasa showed a fairly low point prevalence rate for diarrhoea. Acute diar-

rhoea usually affected children below 2 years whereas one third of children between 2 to 3 years with diarrhoea suffered from persistent disease. Risk factors identified besides age, included non breast-feeding, presence of more than one enteric agent in a stool specimen and living in a household without electricity. As persistent cases carry a substantial risk of death (17), the duration of diarrhoea should be introduced into the case management flow chart used at the HC, in order to better focus on the clinical management of these children. Contrary to the flow chart, faecal WBC and RBC did not suggest an inflammatory diarrhoea, but may be the result of the use of rectal injections and suppositories. Furthermore the mothers' education concerning ORT needs to be continued, as does the promotion of identification of dehydrated children. A campaign against the use of local and chemical treatments is also indicated.

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Enquête communautaire sur la diarrhée chez les enfants en-dessous de 5 ans à Kinshasa, Zaïre.,

Résumé – Une enquête communautaire a été entreprise dans une zone urbaine de Kinshasa, Zaïre, pour évaluer la prévalence, les caractéristiques et les risques de diarrhée chez les enfants de moins de 5 ans. Nous avons examiné 155 cas communautaires sélectionnés suivant la méthode d'échantillonnage groupé, 155 témoins appariés par l'âge et 18 enfants diarrhéiques qui fréquentaient le Centre de Santé (CS) au moment de l'enquête. Le taux de prévalence de la diarrhée était de 6,5 %. Le plus haut risque de diarrhée persistante était couru par les enfants de 2 à 3 ans, sevrés, ayant plus d'un agent entérique dans les selles et vivant dans une maison dépourvue d'électricité. Les taux de détection de *Strongyloïdes stercoralis, Entamoeba histolytica, Salmonella* et des fortes infestations de *Trichuris trichiura* et de *Trichomonas hominis* étaient plus élevés chez les cas ($p < 0,05$). La présence de *Cryptosporidium* était assez fréquente, aussi bien chez les enfants diarrhéiques (14,8 %) que chez les témoins (12,9 %). Aucune présence associative n'a été observée entre les globules blancs fécaux et les bactéries entériques ni entre les globules rouges et *E. histolytica.* Ceci pourrait s'expliquer par l'usage fréquent des lavements et des suppositoires. La perception par la mère de la fièvre et de l'aspect des selles concordait assez bien avec celle des investigateurs (respectivement dans 70 % et 53 % des cas). Le haut taux d'enfants déshydratés (50,9 %) résultait probablement de la définition de la déshydratation qui est appliquée au CS. Les résultats de l'enquête étaient utilisées pour améliorer la stratégie locale plainte-diagnostic-traitement de la diarrhée et adapter les activités éducatives des mères.

Bevolkingsonderzoek naar diarrhee bij kinderen onder de vijf jaar in Kinshasa, Zaïre.

Samenvatting – Dit bevolkingsonderzoek werd gedaan om de prevalentie, kenmerken en risicofactoren van diarrhee bij kinderen onder de vijf jaar in een stedelijk gebied in Kinshasa, Zaïre, vast te stellen. 155 middels cluster sampling geselecteerde cases uit de bevolking, 155 voor leeftijd gematchte controle kinderen en 18 kinderen met diarrhee die naar een gezondheidscentrum (GC) kwamen, werden onderzocht. De prevalentie ratio van diarrhee was 6,5 %. De groep met het hoogste risico op persisterende diarrhee was die van kinderen van 2 tot 3 jaar, niet borstgevoed, met meer dan één microorganisme in de ontlasting en woonachtig in huizen zonder electriciteit. Het aantal gevonden infecties van *Strongyloïdes stercoralis, Entamoeba histolytica, Salmonella* en van zware infecties van *Trichuris trichiura* en *Trichomonas hominis* was significant hoger bij de cases ($p < 0,05$). Het aantal gevonden infecties van *Cryptosporidium* was vrij hoog, met name in GC cases (22,2 %). Het werd zowel gevonden bij kinderen met en zonder diarrhee. Er was geen verband tussen faecale witte bloedcellen en darm bacteriën noch tussen faecale rode bloedcellen en *E. histolytica,* wat eventueel verklaard kan worden door de frequente toediening van rectale injecties en zetpillen. De waarneming van koorts en aspect van de ontlasting door moeders was aardig in overeenstemming (respectievelijk 70 % en 53 %) met dat van de onderzoekers. De hoge aantallen gedehydreerde kinderen (50,9 %) kunnen het gevolg zijn van de definitie van dehydratie die in het gezondheidscentrum werd toegepast. De resultaten van het onderzoek werden gebruikt om het locale behandelingsplan te verbeteren en om de voorlichting aan moeders aan te passen.

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