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Assessment of the Nutritional and Infectious Status of Vulnerable Children Consulted at Beyla Hospital, Guinea

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Abstract

Introduction: Acute malnutrition is a primary health concern among vulnerable children. The objective of this work is to know the nutritional status of the 321 children of these vulnerable children and to assess their infectious states.
Methodology: Smart nutritional survey according to a list drawn up by the community services of the Town Hall. Follow-up of a biological analysis of the stools with the Polymerase Chain Reaction to detect the germ involved. Statistical processing with Smart software.
Results: Rate of acute malnutrition in Z-scores: Prevalence of global acute malnutrition of: (29) 9.03%. With: (17) 5.29% moderate and (12) 3.73% severe. Rate of acute malnutrition as a percentage of the median. Prevalence of global acute malnutrition: (12) 3.73% with (8) 2.49% moderate and (4) 1.24% severe plus edema. Chronic malnutrition rate in Z-scores. Prevalence of global chronic malnutrition: (91) 28.34%. Shigella sonnei DNA alone was found in 20 (6.2%) children. Malnutrition-shigellosis copathology was found in 120 (37.4%) of these children. A total of 140 (43.6%) cases of Shigella sonnei DNA detected (P = 1.4).
Conclusion: Among the 321 vulnerable children, malnutrition was a reality against the backdrop of bloody Shigella sonnei dysentery. Contracted during the various gatherings.

Keywords: Children; Shigella Sonnei; Malnutrition Prevalences; Vulnerable

Abbreviations: CIRITG: Center for Research on Tropical Infections in Guinea; NGOs: Non-Governmental Organizations; GAM: Global Acute Malnutrition; PCR: Polymerase Chain Reaction.

Introduction

Extremely vulnerable people, as their names suggest, are people who live with disabilities. Vulnerability due either to blindness, or that he is deaf-mute or due to a chronic illness, or to a physical or mental handicap, or to age, or linked to the fact that the person is alone with minors, etc. These vulnerable people are with host families in the urban and rural municipality of Beyla. They and their children are listed and known to the community services of the Town Hall. They live on social and food assistance from their hosts and some local Non-Governmental Organizations (NGOs). The International Center for Research on Tropical Infections in Guinea, in its

component of assistance to extremely vulnerable people, provides medical, nutritional and social care for these people in need. Among this target group, many reference cases were observed at the Beyla Prefectural Hospital. A nutritional and bacteriological survey was carried out over one month, from February 1 to 30, 2022 among 321 minor dependent children of these disabled people. This is a first nutritional survey (Smart) situating the impact of the assistance they are subject. Then determine the etiology of the bloody dysentery from which nearly half of these children suffer, possibly following numerous contacts between them during gatherings. Shigellosis is the leading cause of dysentery worldwide [1]. Shigella sonnei, which has always been more commonly isolated in developed countries, is experiencing unprecedented expansion in industrialized regions of Asia, Latin America and the Middle East [2]. The precise reasons underlying the epidemiological distribution of different Shigella species and this global increase in S. sonnei are unclear, but may be due to three major environmental pressures. First, natural passive immunization with the bacterium Plesiomonas shigelloides is believed to protect water-poor populations against S. sonnei [3]. The specific elimination of P. shigelloides from drinking water would therefore lead to a reduction in exposure to these bacteria and a subsequent reduction in environmental immunization against S. sonnei. Second, the ubiquitous amoeba species Acanthamoeba castellanii has been shown to efficiently and symbiotically phagocytose S. sonnei, allowing the bacterium access to a protected niche in which it resists chlorination and other harsh environmental conditions in temperate countries [4].

Finally, S. sonnei emerged from Europe and only started to spread globally relatively recently [5]. Strong selective pressure from the localized use of antimicrobials also seems to have had a dramatic impact on the evolution of the S. sonnei population [6]. We hypothesize that S. sonnei, which exhibits an exceptional ability to acquire antimicrobial resistance genes from commensal and pathogenic bacteria, has a competitive advantage over S. flexneri, especially in areas where the use of antimicrobials is poorly regulated [7]. The continued improvement in the quality of global drinking water supplies alongside the rapid development of antimicrobial resistance predicts that the burden and international distribution of S. sonnei will only continue to grow. An effective vaccine against S. sonnei is overdue and could become one of our only weapons against this increasingly dominant and problematic gastrointestinal pathogen [7]. There are no national statistics or strategies. Clear about Shigellosis in Guinea, the data are sparse and its emergence could be a breeding ground for child malnutrition. A billion people in the world suffer from hunger, according to the calculation of the FAO that is to say approximately one inhabitant in six developing countries [8].

Child malnutrition is wreaking havoc with 68 million children suffering from acute malnutrition (characterized by insufficient weight in relation to height) including 26 million in its most severe form, the stage where the risk of mortality is highest [9]. In Guinea, 25.9% of children suffer from global chronic malnutrition and a precarious Global Acute Malnutrition (GAM) prevalence of 8% [9]. In view of this reality, the French agri-food group Nutriset, which specializes in products for the prevention and treatment of malnutrition, has recommended building an industrial production unit for nutritional supplements in Guinea, including its flagship product, the plumpy nut. High energy peanut-based pasta, used in the community management of acute malnutrition. Thus, even with the effort of UNICEF, the country remains with a malnutrition rate of 2%, overall and severe underweight rates of 16.2% and 4.4%. The acute malnutrition rate according to arm circumference of 5.1%, including 1.3% severe [9]. The death of children under 5 years old, with a rate per day per 10,000 children of 0.58% [9]. All this in a context of recurrent epidemics (Measles, Ebola, COVID 19). Beyla, a town in Forest Guinea, has peri-urban Communes with a population that is essentially agro-pastoral. The area is experiencing strong anthropogenic action that has overcome the immense native forests and numerous waterways that meandered through the area. In view of these health challenges, the Guinean government created the national water point service (SNAPE) which was only able to provide the population of this area with an insufficient number of boreholes and water supply. Taking into account this alarming context, the objective of this work is to determine the etiology of bloody dysentery and the prevalence of malnutrition in vulnerable children from disadvantaged backgrounds who consult at Beyla hospital.

Methods

Location and Type of Studies

The city of Beyla hosted these studies. This was an experimental-type survey study that extended over one month, from February 1 to 30, 2022. The bacteriological analyzes were carried out in the Microbiology and Nutrition sections of the International Center for Research on Tropical Infections in Guinea (CIRIT-G) in Nzérékoré. It involved 321 children dependent on vulnerable people who consult at Beyla hospital. The ethical aspect: all the patients concerned by the study were informed of the objective of this survey and accepted following an informed consent to participate in the study.

Training and Monitoring of Investigators

Team of Nutritionists: After drawing up the data collection sheet, establishing a schedule in collaboration with the heads

of families in the neighborhoods, planning the necessary logistical and financial means, investigators were trained. Most of the investigators already played a role in the health care of the population. All investigators at Baccalaureate and university level were trained for 2 days in anthropometric measurement techniques. During 2 days of training, the objectives of the survey, the sampling techniques were explained. As for the anthropometric measurements, they were demonstrated and practiced by each of the investigators; a practice of 25 measurements of each type per investigator was carried out. The training session was concluded with a pre-survey.

Teams of Bacteriologists: The investigators were reinforced by training on the concept of feverish syndromes (fever at 39-40°C), temperature taking, stool sampling, polymerase chain reaction (PCR), and filling out forms.

Conduct of the Survey, Data Collection. Consumable and Non-consumable from the Laboratory

Following an upgrade, the survey was carried out by five teams, including one per district. Each team was made up of 2 nurse nutritionists, 1 nutritionist, 1 laboratory assistant and a doctor. Under the supervision of the Nutritionist, two Nurse Nutritionists took the anthropometric parameters, checked the edemas and filled out the follow-up sheets. The Laboratory Technician collected the stools and sent those 30 min later to the laboratory for the Polymerase Chain Reaction in real time (PCR). The Doctor ensured the medical consultation and administered the systematic or specific treatment. For each case of fever, the surname and first names, date of birth, age, sex, weight, height, and types of selection (Pb, Z-score or edema) were mentioned on the children's follow-up sheets. The analysis focused on: 321 children (6-59 months) with a systematic survey using a list made by the community services of the Town Hall. From each child undergoing anthropometric measurements, a stool sample was taken for PCR. PCR results came out every day. The children's measuring boards, the Salter scale with panties, plus a survey sheet served as survey materials.

Statistical Processing with Smart

For data analysis, the indicators commonly used and recommended by WHO were used.Weight for height (PT), height for age (TA), weight for age (PA) [8]. The results are presented at the threshold of -2 Zscores (< 80%) and –3 Zscores (< 70%) compared to the NCHS/CDC reference population in terms of: Emaciation or thinness (Wasting): defined by a PT ratio < -2 Zscore of the median of the reference population. This is the indicator of acute malnutrition on recent nutritional status.

• A –2 Zscore< 80% (moderate malnutrition)

• A –3 Zscore< 70% (severe malnutrition)

Growth retardation (stunting): defined by a TA ratio < -2 Zscore of the median of the reference population. It reflects and integrates the child's past. This is the indicator of chronic malnutrition (short stature) [8]. The age of most of the children was fixed using an event calendar held by the social counselor of the Town Hall. Underweight: defined by a PA ratio < -2 Zscore of the median of the reference population. It reflects both wasting and stunting (low weight) [8]. These indices were used for preschool children (6-59 months). The P/T index used for children under 137 cm tall (+ or – 10 years) [8]. People whose one of the variants (weight, height, sex or age) was missing were excluded from the analysis.

Real-time PCR Technique

At the mobile laboratory of the Russian Federation (Rospotrebnadzor) in Guinea, the analysis was carried out as follows: The first step consisted in homogenizing the samples. Samples diluted 1/10th (25 g of stool in 225 ml of sterile distilled water). After cell lysis, the DNA was extracted using different kits to search for the corresponding bacterium [10]. The main pathogenic germs sought in the stool samples were Enterobacteriaceae. The test for bacteria by the PCR method is based on the polymerase chain reaction technique [10]. This method makes it possible to multiply a specific DNA sequence of a bacterium: A first step consists in extracting the DNA of the bacteria present in the sample thanks to solvents which break the cell envelope. This DNA is then filtered and purified. In a second step, the DNA is placed in a thermal cycler where it will be amplified over forty cycles. The DNA sequences duplicated during one cycle serve as a basis for duplication in subsequent cycles. This allows exponential multiplication of the number of significant DNA fractions. During this duplication phase, a fluorescent chemical marker is attached to the sequences of the duplicated bacteria to measure semi-quantitatively (+++, ++, +, +/-, -) by spectrometric reading, the presence of the bacteria in the initial sample [10]. One week after the survey, the data were entered and analyzed with the SMART software to compare data by the Student's calculation and to determine the rates of malnutrition, mortality, vaccination coverage and that of Vitamin A. The results of this search are grouped into two categories:

1- Patients in who only bloody dysentery due to Shigella sonnei have been identified;

2- Patients in whom both bloody Shigella sonnei dysentery and acute or chronic malnutrition have been identified (Co-pathology)

Results

The frequency of types of vulnerability and the % Vulnerability of parents of children aged 6-59 months are

shown in Table 1.

Vulnerability	Frequency	Percentage
Blind	8	2,5
Deaf mute	3	0,9
Chronically ill	197	61,4
Epilepsy	4	1,2
Mentally ill	12	3,7
Disabled hand	12	3,7
Disabled feet	11	3,4
Daughter mother	74	23,1
Total	321	100

Table 1: Distribution by vulnerability of parents of dependent children.

The chronically ill (61.4%) and single mothers (23.1%) are the most numerous among these parents of children.

The investigation revealed the existence of one case of a child aged 6-59 months per vulnerable person. Thus, the number of vulnerable is equal to the number of children. Tables 2-4 indicates the districts of residence, the number of children per district, and the % of children aged 6-59 months per district.

Quartier	Nombre	%
Sobakono	89	27,7
Boufèro	51	15,9
M'Balia	52	16,2
Gnèlasilala	58	18,1
Kissiboula	71	22,1
Total	321	100

Table 2: Distribution by district of dependent children aged 6-59 months.

It is in the popular districts of Sobakono and Kissiboula that we find the greatest number of children.

Age/month	Boy Number	%	Girl Number	%	Total Number	%	Ratio Boy/girl
17-Jun	22	6,9	23	7,2	45	14,0	1,0
18 - 29	34	10,6	27	8,4	61	19,0	1,3
30 - 41	38	11,8	33	10,3	71	22,1	1,2
42 - 53	51	15,9	36	11,2	87	27,1	1,4
54 - 59	28	8,7	29	9,0	57	17,8	1,0
Total	**173**	**53,9**	**148**	**46,1**	**321**	**100**	1,1

Table 3: Simple distribution of children from 6 to 59 months by age group and sex.

The age groups of 42-53 (27.1%) and 30-41 (22.1%) are respectively the most numerous. The boys are also the most numerous with a ration of 1.1.

Parameters Studied	Number	%	% Interval of trust (IC à 95%)
Acute malnutrition rate in Z-scores			
Prevalence of global malnutrition acute :	29	**9,03**	(3,6 - 7,1)
Prevalence of moderate acute malnutrition:	17	5,29	(3,1 - 6,3)
Prevalence of severe acute malnutrition:	12	3,74	(0,1 - 1,1)
Acute malnutrition rate as a percentage of the median			
Prevalence of global malnutrition acute:	12	3,73	(1,4 - 3,7)
Prevalence of moderate acute malnutrition	8	2,49	(1,2 - 3,3)
Prevalence of severe acute malnutrition	4	1,24	(0,1 - 0,7)
Chronic malnutrition rate in Z-scores	91		(49,2 - 67,5)
Prevalence of Global Chronic Malnutrition:		28,3	
Prevalence of moderate chronic malnutrition**:**	56	17,4	(28,0 - 31,8)
Prevalence of severe chronic malnutrition:	35	10,9	(31,0 - 38,7)

Arm Circumference			
Arm circumference < 110 mm:		0	
MUAC >=110mm and PB<120mm:		2	
* for children with a height between 75 cm and 110 cm			
Mortality rate among 321 children			
Overall death rate:	0,18/10 000 par jour		(0,22-0,56)
Mortality rate for children under 5:	0,19/10 000 par jour		(0,33-1,41)
Measles vaccination coverage			
90.1% of children aged 9 to 59 months were immunized against measles, including 4.2% verified on vaccination cards and 85.9% of children vaccinated according to their mothers' statements			
Vitamin A coverage			
90.2% of children aged 6 to 59 months received the dose of vitamin A, according to the declaration of their mothers.			

Table 4: Prevalence of malnutrition among the 321 children.

Other additional parameters such as the mortality rate, anti-measles vaccination and vitamin A coverage were calculated (acute malnutrition 29 cases plus 91 cases of chronic malnutrition make 120 cases of malnutrition in these children. These 120 malnourished all suffered from bloody dysentery, therefore carriers of S sonnei DNA.

Bacteriological analysis by the real-time polymerase chain reaction (PCR) method, carried out by CIRIT/G (International Center for Research on Tropical Infections in Guinea) identified 20 cases of bloody dysentery alone without being associated with other diseases. These results are recorded in Table 5 below.

Age/ month	Boy Number	cas positif	%	Girl Number.	cas positif	%	Total Number.	cas positif	%
17-Jun	22	3	0,9	23	2	0,6	45	5	1,6
18-29	34	2	0,6	27	0	0,0	61	2	0,6
30-41	38	1	0,3	33	4	1,2	71	5	1,6
42-53	51	3	0,9	36	3	0,9	87	6	1,9
54-59	28	0	0,0	29	2	0,6	57	2	0,6
Total	173	9	2,80	148	11	3,4	321	20	6,2

Table 5: Positive cases of Shigella sonnei alone by age group and sex.

6.2% DNA positivity of Shigella sonnei alone was detected, including 2.8% in boys versus 3.4% in girls. (Real-time PCR). These 20 children were not malnourished.

The analysis also showed a copathology, association (malnutrition and bloody dysentery at S sonnei) in 120 children, i.e. 37.4% (Table 6).

Age/ month	Boy Number	cas positif	%	Girl Number.	cas positif	%	Total Number.	cas positif	%
17-Jun	22	17	5,3	23	13	4,0	45	30	9,3
18-29	34	15	4,7	27	11	3,4	61	26	8,1
30-41	38	7	2,2	33	14	4,4	71	21	6,5
42-53	51	16	5,0	36	10	3,1	87	26	8,1
54-59	28	9	2,8	29	8	2,5	57	17	5,3
Total	**173**	64	19,94	148	56	17,4	321	120	37,4

Table 6: Co-pathology: Malnutrition – bloody dysentery due to *Shigella sonnei.*

120 (37.4%) of Shigella sonnei DNA positivity were detected. These 120 children all suffered from malnutrition.

Discussion of the Results

Three hundred and twenty-one (321) children aged 6 to 59 months are children who depend on the 321 Vulnerable. Among these vulnerable parents, the chronically ill (61.4%) followed by single mothers (23.1%) are the most numerous (Table 1). It is in the popular neighborhoods of Sobakono and Kissiboula that we find the greatest number of dependent children (Table 2). Among these dependent children, the age groups of 42-53 (27.1%) and 30-41 (22.1%) are respectively the most numerous. Boys are also more numerous than girls with a ratio of 1.1 (Table 3). These dependent children have a prevalence of global acute malnutrition at the Z-score of (29) 9.03% against 8% the national rate. These rates indicate a precarious nutritional situation, given the risk factors linked to the current epidemic contexts in the region (measles, (Covid 19, Ebola virus hemorrhagic fevers, Lassa fever)). The rate of global acute malnutrition as a percentage of the median is 3.73% That of chronic malnutrition is (91) 28.3% of which 10.9% is severe Twenty-nine (29) cases of acute malnutrition plus 91 cases of chronic malnutrition make 120 cases of Malnutrition All age groups are equally affected for both girls and boys (p = 0.6) Of the 321 children, 289 children aged 9 to 59 months, i.e. 90.1% were immunized against measles, including 4.2% verified on vaccination cards and 85.9% of children vaccinated according to their mothers' declarations 90.2% of children aged 6 to 59 months received the dose of vitamin A, according to the statement of their mothers. Taking into account only this rate verified on the vaccination cards, it is easy to conclude that these two activities must be strengthened to protect children from diseases and nutritional deficiencies. In Forest Guinea, Shigella sonnei infection has taken on epidemic momentum given the growing insalubrity, the large movements of people, and the permanent gatherings of the vulnerable and the wandering of livestock. Caroline.N. Thompson, Pham ThanhDuy, Stephen Baker by a study conducted in (2015) [1], confirmed the risk of predominance of S. sonnei in the etiology of bacillary dysentery.

In this study, 20 (6.2%) cases of Shigella sonnei-only bloody dysentery were identified. 2.8% for boys, against 3.4% for girls with 1.9% of S. sonnei infection found in the age group of 42-53 months followed by 1.6% for the group of 30 -41 months. The study also showed an association of pathology: acute or chronic malnutrition associated with bloody S sonnei dysentery: i.e. 120 malnourished children in whom the presence of Shigella sonnei DNA was revealed (Table 6). If in total, with PCR, a highly sensitive and specific method, this study found 140 cases (43.6%) of S. sonnei, it must be recognized that this Bacillus of Carl Olaf Sonne is distributed throughout the world and represents the most common cause of shigellosis in industrialized regions of Europe, North America, and Australia, Baní, Malik (2021) [4]. It is currently being expanded to middle-income countries across Asia, Latin America, the Middle East and now Africa [4]. S. sonnei evolved from Escherichia coli to specialize in infections of the human intestinal epithelium [4].

Conclusion

Shigellosis due to Shigella sonnei would therefore be the main cause of the bloody dysentery observed among these 321 children, a favorable ground for acute malnutrition. The analyzes revealed co-pathology: bloody dysentery caused by Shigella sonnei associated with acute or chronic malnutrition in 120 children. S sonnei DNA alone was found in 20 other children (6.2%) who were not malnourished. In total, Shigella sonnei DNA was found in 140 children, i.e. 43.6%. A figure that is close to half of the children in the study. P= 1.4, a non-significant difference. Vaccination and vitamin A supplementation of these children are key recommendations in the fight against these diseases.

Contribution of the Authors

SM: design, research methods, SY: molecular analysis; SL and MFO: Interpretation of results, CTD: drafting data control.

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