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Feeding Practices, Nutritional and Hemoglobin Status of Children Aged 6 to 59 Months in the Republic of Guinea: A Case Study of the Prefecture of Fria

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Abstract: Malnutrition is a major public health concern in developing countries, contributing to 45% of deaths among children under five years old. In the Republic of Guinea, the prevalence of acute malnutrition is estimated at 6.7%, largely influenced by inadequate breastfeeding and complementary feeding practices. A descriptive cross-sectional study was conducted in the Prefecture of Fria to assess the impact of feeding practices on the growth and development of children aged 6 to 59 months. A sample of 450 children residing in the prefecture was included in the study. The findings revealed a prevalence of acute malnutrition of 8.9%, while 4.4% of the children were underweight, and 7.1% suffered from chronic malnutrition.

Key words: Feeding practices, Fria, malnutrition, children aged 6 to 59 months.

1. Introduction

Malnutrition remains a major public health challenge, particularly in developing countries, where it is estimated to contribute to 45% of deaths among children under five years old [1]. According to the WHO (World Health Organization), 2021 data indicate that malnutrition accounts for 11% of the global burden of disease, with long-term health consequences for individuals who experienced malnutrition, negatively impacting children's education and growth. Among children under five years old, 52 million suffer from wasting, including 17 million in its severe form, 155 million are stunted, and 41 million are overweight or obese [2].

In the DRC (Democratic Republic of Congo), approximately 3.3 million children aged 6 to 59 months suffer from acute malnutrition, including one million severe cases [3]. In the Republic of Guinea, the 2022 (Standardized Monitoring and Assessment of Relief and Transitions) survey revealed that the national prevalence of global acute malnutrition among children aged 6 to 59 months is 6.7%, a worrying situation according to WHO classification, with 25.5% of these children stunted and 14.6% underweight [4].

The period between 0 and 2 years is crucial as it marks the transition from liquid milk feeding to semi-solid and solid foods in infants. Severe acute malnutrition is often associated with anemia (iron deficiency), linked to metabolic adaptations resulting from weight loss and edema, reducing physical and intellectual capacities, weakening the immune system, and increasing the risk of infant mortality [5, 6].

The nutritional status of children mainly depends on three factors: diet, environment, and care practices [7].

Other major causes of infant mortality are associated with poor breastfeeding practices, early and inappropriate

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Fig. 1 The state of malnutrition in a child and their condition after nutritional care in the Prefecture of Fria.

introduction of complementary foods into the infant's diet. Inadequate complementary feeding starting at six months can impair growth over the next twelve months [8].

Extensive research and WHO recommendations on the production and use of infant foods have been reported. Given the prevalence of malnutrition in certain regions of the Republic of Guinea, particularly in the Prefecture of Fria (Fig. 1), and the absence of specific studies on this topic, this research was deemed necessary: Feeding Practices, Nutritional Status, and Hemoglobin Profiles of Children Aged 6 to 59 Months in the Republic of Guinea: A Case Study of the Prefecture of Fria. The objective of this study is to determine the impact of feeding practices and hemoglobin profiles on the nutritional status of children aged 6 to 59 months, while considering various epidemiological factors that may influence these conditions.

2. Materials and Methods

2.1 Study Area and Context

The Republic of Guinea serves as the study area, with a particular focus on the Prefecture of Fria, which includes several representative enumeration zones (Fig. 2).

2.2 Data Collection and Working Materials

- Electronic scale;
- Contaminated waste disposal boxes;
- Alcohol-soaked cotton balls;
- Blood pressure cuff;
- Survey forms;
- Latex gloves;

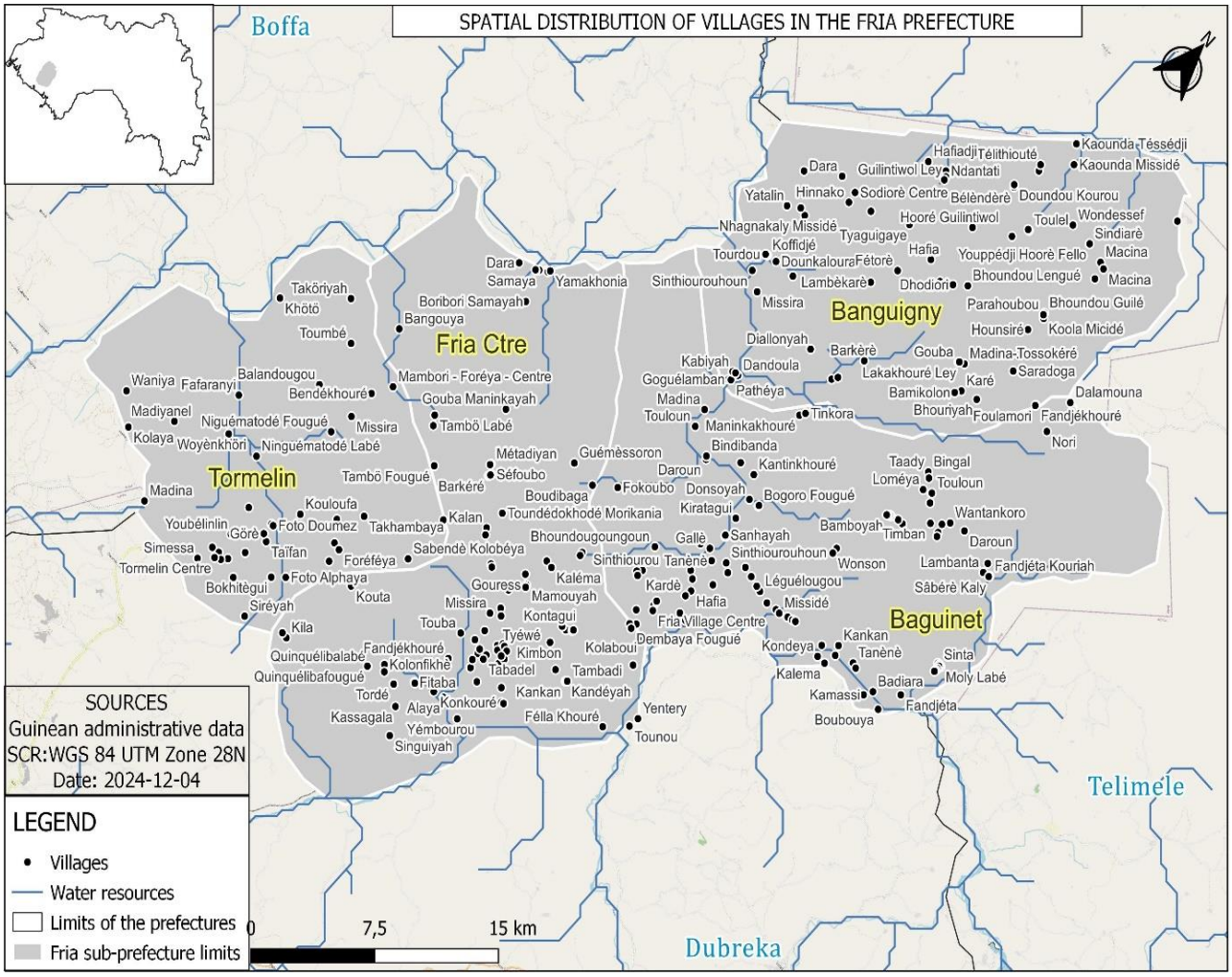

Fig. 2 Map of the Prefecture of Fria and its rural communes.

- Auto-retractable lancets (at least 2.25 mm);
- Hemocue micro-cuvettes;
- Stadiometer.

2.3 Sampling

- Sampling frame: The sampling frame used was the list of EZ (Enumeration Zones) from the RGPH 2014 (General Population and Housing Census 2014) [9].
- Cluster selection: Clusters (primary sampling units) were selected using proportional sampling based on the population size of the strata.
- Household selection: After enumeration of the EZs, households were randomly selected.
- Child selection: All children aged 6 to 59 months from the selected households were included.

2.4 Methods

2.4.1 Study Design

This study was based on data collection using pre-designed questionnaires. A cross-sectional and descriptive survey was conducted over a period of three months, from December 1, 2023, to February 29, 2024. This approach enabled the collection of epidemiological, hemoglobin, anthropometric, and dietary practice data concerning children aged 6 to 59 months in the Prefecture of Fria, Republic of Guinea.

2.4.2 Data Collection

Data were collected using pre-established forms. Information was digitized and securely managed using the (KoBoToolbox) Collect application.

2.4.3 Study Population

The sample included all children aged 6 to 59 months who met the inclusion criteria, with informed consent obtained from mothers or guardians of the children (Prefecture of Fria).

2.4.4 Sample Size Calculation

The sample size for the anthropometric study was determined using the ENA software (version 2016), accounting for a 3% non-response rate. The average sample size was calculated based on the prevalence of GAM (Global Acute Malnutrition) in the Prefecture of Fria, which is 5%, following the formula:

$$N = \frac{z^2 \times p \times (1-p) \times e}{D^2 \times r}$$

- z: Statistic corresponding to the required confidence level. For a 95% confidence level, the value used is 1.96.
- p: Estimated prevalence of GAM in the Boké region, assessed at 5% according to the SMART Guinea survey, 2022.
- e: Effect of the survey design, representing the ratio between the actual variance and the theoretical variance of a simple random sample. Given the use of cluster sampling, a default value of 1.5 is chosen to account for the high homogeneity among individuals within the same cluster.
- r: Expected response rate, adjusted to reflect the specificities of surveys in Guinea. For the SMART Guinea 2022 survey, this rate was 96%.
- D: Tolerable absolute margin of error, set at 0.08 (or 8% of the studied phenomenon) for this survey.

Based on the formula, the calculated sample size is 428 children, corresponding to 30 enumeration zones as per WHO recommendation [10].

2.4.5 Studied Variables

2.4.5.1 Anthropometric Variables

- Weight
- Height
- Arm circumference

2.4.5.2 Clinical Variables

- Nutritional edema

2.4.5.3 Biological Variable

- Hemoglobin

2.4.5.4 Epidemiological Variables

- Age
- Residence
- Gender

2.4.5.5 Dietary Variables

- 24-hour dietary recall

2.4.5.6 Data Analysis

The anthropometric indices were calculated according to the WHO standards (2006) using the ENA software (January 2020). Data analysis continued with Epi Info version 7 and SPSS version 22.

2.4.5.7 Ethical Considerations

Before data collection began, the research protocol, approved after its defense, was submitted to the National Ethics Committee for Health Research for approval. Furthermore, before each survey, verbal informed consent was systematically obtained from the participants, with a strict commitment to ensuring the anonymity and confidentiality of the information collected.

3. Results

Among the 450 children in the study, 52% were boys and 48% were girls, with a slight male predominance (ratio of 0.9). The children were divided into five age groups, ranging from 6 to 59 months. The most represented age group was 6 to 17 months, comprising 35.1% of the sample, followed by 18 to 29 months with 24%. In terms of gender distribution, the majority of children aged 6 to 17 months were boys (55.7%), while girls outnumbered boys in the 30 to 41 months age group (64.2% girls). In general, the male-to-female (M/F) ratio varies by age group, reaching a maximum of 1.2 for 6-17 months and a minimum of 0.8 for 30 to 41 and 42 to 53 months. The distribution of children by age and gender reveals some variability in the gender distribution depending on age. While the majority of children are male in the younger age groups, girls are more numerous in the older age groups, which may

reflect differences in infant survival or other socio-environmental factors.

The analysis of the prevalence of acute malnutrition, defined by a weight-for-height (W/H) index below -2 z-scores, shows an overall acute malnutrition rate of 8.9%. This rate is broken down into 3.3% severe cases (SAM) and 5.6% moderate cases (MAM). In contrast, 83.3% of the children in the sample show no signs of acute malnutrition. The data reveals that all age groups are affected by this form of malnutrition, although the rate varies by age. The 6 to 17 months age group has the lowest prevalence of malnutrition (5.7%), with only 2.5% of severe cases, while the 54 to 59 months age group shows an alarming 29.4% severe malnutrition rate. These results highlight a concerning issue of acute malnutrition, especially in the older age groups. The relatively high prevalence of moderate and severe malnutrition in certain age groups suggests inadequate food intake, recurrent infections, and poor nutritional and caregiving practices as the main causes of this malnutrition. This is particularly pronounced during the critical phase of transition between exclusive breastfeeding and complementary feeding, a period when children are particularly vulnerable. Although 83.3% of the children show no signs of acute malnutrition, the rates of moderate and severe malnutrition underscore the urgent need to strengthen nutritional and caregiving practices during this sensitive period. Targeted interventions must be implemented to improve the nutrition of young children and promote appropriate care during this transitional phase, in order to prevent and treat acute malnutrition.

Table 1 Distribution of children by age and sex.

Age (months)	Boys (no.)	Boys (%)	Girls (no.)	Girls (%)	Total (no.)	Total (%)	Boy/girl ratio (B/G)
6-17	88	55.7	70	44.3	158	35.1	1.2
18-29	54	50.0	54	50.0	108	24.0	1
30-41	34	35.8	61	64.2	95	21.1	0.8
42-53	48	66.7	24	33.3	72	16.0	0.8
54-59	10	58.8	7	41.2	17	3.8	1
Total	234	52.0	216	48.0	450	100	0.9

Table 2 Prevalence of acute malnutrition according to weight-for-height *z*-scores and/or edema by age group.

Age (months)	Total (no.)	MAS (<-3 *z*-score) (no.)	MAS (%)	MAM (≥ -3 and <-2 *z*-score) (no.)	MAM (%)	Normal (≥ -2 *z*-score) (no.)	Normal (%)
6-17	158	4	2.5	5	3.2	149	94.3
18-29	108	2	1.9	7	6.5	99	91.7
30-41	95	3	3.2	4	4.2	88	92.6
42-53	72	1	1.4	6	8.3	65	90.3
54-59	17	5	29.4	3	17.6	9	52.9
Total	450	15	3.3	25	5.6	410	91.1

Table 3 Prevalence of underweight according to weight-for-age *z*-scores and edema, by age group.

Age (months)	Total (no.)	IPS (<-3 *z*-score) (no.)	IPS (%)	IPM (≥ -3 and <-2 *z*-score) (no.)	IPM (%)	Normal (≥ -2 *z*-score) (no.)	Normal (%)
6-17	158	4	2.5	2	1.3	152	96.2
18-29	108	2	1.9	1	0.9	105	97.2
30-41	95	2	2.1	2	2.1	91	95.8
42-53	72	1	1.4	1	1.4	70	97.2
54-59	17	2	11.8	2	11.8	13	76.5
Total	450	11	2.4	8	1.8	431	95.8

The analysis of the prevalence of underweight, defined by a weight-for-age (W/A) index below -2 z-scores, reveals that 4.4% of the children in the study are underweight. Among them, 2.4% suffer from severe underweight (SU) and 2% from a moderate form (MU). In contrast, 96% of the children show normal nutritional status. All age groups are affected by this form of malnutrition, although the overall rate of underweight is relatively low. The 54 to 59 months age group has the highest rate of underweight (23.5%), mainly due to severe cases, indicating a particular vulnerability of these children at this stage of their development. Despite a high percentage of children (96%) with normal nutritional status, the 4.4% underweight rate remains concerning, particularly due to its presence across all age groups. This form of malnutrition, though moderate, underscores the need for continuous monitoring of children's weight, especially during rapid growth phases, when the risk of malnutrition may increase. The results suggest that it is crucial to implement targeted interventions to improve nutritional intake, particularly for children at risk of underweight. Such actions should include special attention to complementary feeding and nutritional education for mothers and caregivers, to prevent and mitigate the risks of underweight.

The prevalence of chronic malnutrition, measured by a height-for-age index below -2 z-scores, is 7.1%, with 3.3% of severe cases and 3.8% of moderate cases. Although the majority of children (92.9%) have normal development, children over 24 months, particularly those aged 54 to 59 months, are especially vulnerable to this form of malnutrition. At this age, chronic malnutrition often becomes irreversible, affecting their long-term growth and development. Although chronic malnutrition is less frequent than acute malnutrition, it remains a significant health issue, especially after the age of 24 months. The high rates among children aged 42 to 59 months (up to 29.4% severe malnutrition) highlight the need for monitoring and targeted interventions during this critical period. It is imperative to implement early nutritional interventions to prevent the irreversible consequences of chronic malnutrition. This includes nutrition programs starting in early childhood, improved parental education on feeding, and appropriate healthcare. Targeted actions should also be developed for vulnerable children, particularly beyond 24 months, to support their physical and cognitive development.

Table 4 Prevalence of chronic malnutrition according to height-for-age *z*-scores by age group.

Age (months)	Total (no.)	MCS (<-3 *z*-score) (no.)	MCS (%)	MCM (≥ -3 and <-2 *z*-score) (no.)	MCM (%)	Normal (≥ -2 *z*-score) (no.)	Normal (%)
6-17	158	3	1.9	5	3.2	150	94.9
18-29	108	2	1.9	3	2.8	103	95.4
30-41	95	1	1.1	5	5.3	89	93.7
42-53	71	4	5.6	2	2.8	66	91.7
54-59	17	5	29.4	2	11.8	10	58.8
Total	450	15	3.3	17	3.8	418	92.9

Table 5 Distribution of children based on hemoglobin levels.

Typology	Hb Level (g/dL)	Number (no.)	Percentage (%)
Normal	Hb ≥ 12	265	58.9
Mild	10 ≤ Hb < 12	129	28.7
Moderate	7 ≤ Hb < 10	15	3.3
Severe	Hb < 7	41	9.1
Total		450	100

The results of this table show that 58.9% of the children have a normal hemoglobin level (Hb ≥ 12 g/dL), 28.7% have mild anemia (Hb between 10 and 12 g/dL), 3.3% have moderate anemia (Hb between 7 and 10 g/dL), and 9.1% suffer from severe anemia (Hb < 7 g/dL). Although the majority of children have a normal hemoglobin level, nearly 41% have some form of anemia, highlighting the importance of targeted nutritional interventions, especially for moderate and severe cases. Such a high prevalence of anemia requires urgent actions to improve iron intake and prevent long-term health effects for the children.

4. Discussion

The data from our study reveal significant results regarding the nutritional and hematoparasitic status of children aged 6 to 59 months in the studied prefecture (Table 1). Among the 450 children included, the male-to-female ratio is 0.9, with the majority of children in the age group of 6 to 17 months, representing 35.1% of the sample. These data align with the findings of the study by Bacar Seydou [11] in Mali in 2020, which reported a ratio of 0.8 and a similar distribution in this age group, indicating a predominance of boys. This parallel highlights comparable trends in geographically similar contexts, which may reflect similar socio-economic, cultural, or environmental factors. The analysis of acute malnutrition (Table 2) shows an overall prevalence of 8.9%, with 3.3% of severe cases and 5.6% of moderate cases. In comparison, the study conducted by Mandla et al. [12] in South Africa in 2022 reported a lower overall prevalence of 6.3%, consisting of 2% severe cases and 4.3% moderate cases, representing a difference of 2.6%. This difference is likely due to variations in dietary practices, access to healthcare, and differences in awareness of nutrition issues. These figures reflect a nutritional emergency, calling for strengthened interventions in our study area (Prefecture of Fria) to reduce the prevalence of acute malnutrition. Regarding underweight (Table 3), our study indicates an overall prevalence of 4.2%, with 2.4% of severe cases and 1.8% of moderate cases. This rate exceeds the one observed in the Ngaboyeka study in the DRC in 2023, where the prevalence was 3.1% (1.2% severe cases and 1.9% moderate cases) [13]. This finding underscores a concerning situation, necessitating measures to prevent underweight deficiencies in children. Global chronic malnutrition (Table 4) affects 7.1% of the children in our study, distributed as 3.3% severe cases and 3.8% moderate cases. This problem is present in all age groups, although children over 24 months are the most vulnerable. In comparison, the study by Suryawan et al. [14] in Indonesia in 2022 revealed a 10% prevalence of overall growth delay in children. However, our result is lower than theirs, indicating that chronic malnutrition persists across all age groups [14]. In terms of hemoglobin profiles (Table 5), 28.7% of children suffer from mild anemia, 3.3% from moderate anemia, and 9% from severe anemia. Only 58.9% show normal hemoglobin levels, exposing a large part of the child population to growth risks and cognitive development issues. The result in Table 5 is lower than the findings by Moate et al. [15] in 2022. This highlights the need to strengthen strategies to improve access to iron-rich foods and introduce supplementation and deworming programs to reduce anemia rates in this vulnerable population.

5. Conclusion

In this study, we examined the dietary practices, nutritional status, and hemoglobin profiles of children aged 6 to 59 months in the Prefecture of Fria, Republic of Guinea. The results indicate that malnutrition and anemia are significant concerns. However, despite an overall satisfactory nutritional status for 96% of the children in terms of body weight, the prevalence of acute malnutrition, underweight, chronic malnutrition, and high anemia rates among children in this area highlight the vulnerability of this population in terms of growth and cognitive development. The results obtained in this study, when compared with findings from other West African countries, reveal disparities

that emphasize the need to adopt context-specific approaches to address these public health issues. The findings of this study highlight the urgent need to intensify prevention and intervention efforts, particularly through nutritional education programs, improved access to balanced and nutritious food, and initiatives promoting iron supplementation to combat anemia. Additionally, it is critical to invest in strengthening local healthcare systems, especially by training healthcare personnel to improve screening and more effectively manage cases of malnutrition and anemia. Finally, this study serves as a foundation for future research and interventions on child nutrition in the Prefecture of Fria, and calls for collective action to reduce malnutrition and anemia rates among children, ensure their well-being, and promote their optimal development.

References

[1] WHO. 2021. "Key Facts on Malnutrition: United Nations Decade of Action on Nutrition." https://www.who.int/fr/news-room/fact-sheets/detail/malnutrition.

[2] OMS/FAO d'experts. 2003. "Regime Alimentaire, Nutrition et Prevention des Maladies Chroniques." https://iris.who.int/bitstream/handle/10665/42754/WHO_TRS_916_fre.pdf.

[3] EDS-DRC. 2023. *Demographic and Health Survey Report: Democratic Republic of Congo EDS-RDC III, 2023-2024.* Brazzaville: EDS-DRC.

[4] SMART Guinea. 2022. *Final Report of the National Assessment of the Nutritional Situation Using the SMART Methodology in Guinea 2022*.

[5] Salam, Rehana, A., Das, J. K., and Bhutta, Z. A. 2020. "Integrating Nutrition into Health Systems: What the Evidence Advocates." *Maternal & Child Nutrition* 15 (Suppl. 1): e12738. https://doi.org/10.1111/mcn.12738.

[6] Sotto, J. J., and Bruce, G. 2021. "Microcytic Anemias due to Iron Deficiency." https://www.msdmanuals.com/fr/professional/h ématologie-et-oncologie/an émies-caus és-par-un-trouble-de-l- érythropo ïèse/an émie-ferriprive.

[7] FIDA. 2022. "Chapitre 2: La Securite Alimentaire Etla Nutrition." https://openknowledge.fao.org/server/api/core/bitstreams/e612bf8f-5be5-4c9d-8ee1-a8cc9045dc96/content/sofi-2022/global-nutrition-targets-trends.html.

[8] CILSS. 2022. "Permanent Inter-State Committee for Drought Control in the Sahel: Regional Report on Food and Nutrition Security in the Sahel and West Africa."

[9] Report by the Ministry of Planning and International Cooperation, National Institute of Statistics (INS), Central Census Bureau (BCR), Third General Population and Housing Census (RGPH-3). https://www.stat-guinee.org/images/Documents/Publications/INS/rapports_enquetes/RGPH3/RGPH3_etat_structure.pdf.

[10] Kish, L. 1965. *Survey Sampling.* New York: John Wiley & Sons.

[11] Seydou, B. 2020. "Determinants of Nutritional Status of Children Aged 6-59 Months and Their Mothers in the Y éliman é, Baraou éli, Kati, Kolokani, and Bandiagara Circles from 2018-2020."

[12] Mandla, N., Mackay, C., and Mda, S. 2022. "Prevalence of Severe Acute Malnutrition and Its Effect on Under-Five Mortality at a Regional Hospital in South Africa." *South African Journal of Clinical Nutrition* 35: 149-54.

[13] Ngaboyeka, G., Bisimwa, G., Neven, A., Mwene-Batu, P., Kambale, R., Kingwayi, P. P., Chiribagula, C., Battisti, O., Dramaix, M., and Donnen, P. 2023. "Association Between Diagnostic Criteria for Severe Acute Malnutrition and Hospital Mortality in Children Aged 6-59 Months in the Eastern Democratic Republic of Congo: The Lwiro Cohort Study." *Frontiers in Nutrition* 10: 1075800. https://doi.org/10.3389/fnut.2023.1114676.

[14] Suryawan, A., Jalaludin, M. Y., Poh, B. K., Sanusi, R., Tan, V. M. H., Geurts, J. M., and Muhardi, L. 2022. "Malnutrition in Early Life and Its Neurodevelopmental and Cognitive Consequences: A Scoping Review." *Nutritional Research Reviews* 35: 136-49. https://doi.org/10.1017/S0954422422000183.

[15] Moate, T., Rabie, T., Minnie, C., and M ænp ää, A. 2022. "Comorbidities of Child Malnutrition in Low-and Medium-Income Countries: A Systematic Review." *Journal of Pediatric Gastroenterology and Nutrition* 75 (4): 400-10.