Prevalence and factors associated with anaemia in malnourished children seen at Saint Camille Hospital in Ouagadougou, Burkina Faso

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Abstract

Background: Anaemia remains a major public health concern in Burkina Faso. particularly among malnourished children. Despite its widespread impact. limited research has explored its prevalence and associated factors in this vulnerable group.

Objectives: This study aimed to determine the prevalence of anaemia and identify contributing factors among malnourished children aged 6 to 59 months prior to any nutritional intervention.

Method: A prospective study was conducted from February to March 2021 involving 139 systematically recruited children at Saint Camille Hospital in Ouagadougou. Data collection included structured questionnaires and blood sampling. Anthropometric measurements and statistical analyses were performed using ENA and SPSS software.

Results: The prevalence of anaemia was 73.4%. Significant associated factors included low maternal education (p=0.046). father's occupation (p=0.017). underweight status (p=0.001). acute malnutrition (p=0.043). and low dietary diversity score (p=0.021).

Conclusions: These findings highlight the multifactorial nature of anaemia. influenced by both nutritional and sociodemographic determinants. Strengthening iron supplementation and nutrition education programs is urgently needed to address anaemia among malnourished children and improve child health outcomes in Burkina Faso.

Keywords: Infantile anemia, prevalence, malnutrition, ouagadougou, burkina faso

Indtroduction

Anaemia has been considered a major public health problem since 1949 by the World Health Organization (WHO). It remains a significant concern. as more than 40% of children aged 6 to 59 months worldwide still suffered from it in 2019 [1]. This proportion reached approximately 70% in 11 countries identified by the WHO. including Yemen and ten countries in West and Central Africa [2]. Iron deficiency. caused by prolonged inadequate dietary intake. is the most common cause of anaemia. It is often exacerbated in disadvantaged regions. particularly in the presence of severe malaria and infectious diseases [3]. In Burkina Faso. 16.2% of the population consists of children under the age of five. whose health situation remains a cause for concern [4]. Anaemia is a major public health problem there. associated with an increased risk of morbidity and mortality. particularly among children under five and pregnant women [5]. Children with anaemia are 4.3 times more likely to die than children without anaemia [6]. The nutritional survey conducted in Burkina Faso revealed prevalence rates of 9.1% for acute malnutrition. 17.6% for underweight children. and 24.9% for chronic malnutrition [7]. In addition to these forms of malnutrition. a prevalence of 83% anaemia was observed in children under five. including 3.1% severe cases [18]. Another study on the prevalence and progression of maternal and infant anaemia in Burkina Faso also reported a prevalence of 87.6% in children [9]. Malnutrition creates conditions conducive to the development of anaemia. In malnourished children. the body's vital functions deteriorate in order to adapt to minimal calorie intake. which slows down the absorption of micronutrients and promotes the development of anaemia [10]. According to the results of the Demographic and Health Survey conducted in Burkina Faso in 2021. the prevalence of anaemia among children aged 6 to 59 months was 72%. This worrying situation requires the urgent implementation of appropriate interventions. particularly through targeted nutrition and health measures [11]. However. data on anaemia in malnourished children remain limited. It is in this context that the present study was conducted. with the aim of identifying the main risk factors associated with anaemia in malnourished children aged 6 to 59 months.

Methods

Study setting

This study was conducted at the Saint Camille Hospital in Ouagadougou (HOSCO). a hospital located in the Bogodogo health district in Ouagadougou. the capital of Burkina Faso. Founded in 1974 by the Camillian Order. it is located in Sector 14 on Babanguida Avenue. The Center for Recovery and Nutritional Education (CREN). the specific location of this study. is part of the pediatrics department. It operates mainly on its own resources and currently receives support from the Regional Health Department of the Center. particularly for the supply of therapeutic milk and PlumpyNut. Care for children suffering from acute

malnutrition is provided there on a daily basis. The center takes charge of new cases. updates individual files and the registry. provides nutritional advice. and organizes educational cooking demonstrations.

Type of study
The study was prospective over a period of two months. from February to March 2021.

Study population
The study population consisted of 139 malnourished children aged 06 to 59 months seen at Saint Camille Hospital of Ouagadougou during the study period.

Inclusion and exclusion criteria
All children aged 06-59 months who were newly admitted to the HOSCO CREN with confirmation of the state of malnutrition based on anthropometric indices were included. All children whose state of malnutrition was not confirmed or who were already malnourished and were in the follow-up phase were excluded.

Sampling and sample size
The sample size was obtained through systematic recruitment during the study period. The study included 139 malnourished children who met the inclusion criteria.

Data collection
Data was collected by interviews through a standardized form with the parents of the patients allowing us to obtain individual information related to the child and those of the household. The individual characteristics of the child. age. sex. rank in the siblings. vaccination status. low birth weight. anthropometric variables and clinical examinations were recorded. The variables related to the socioeconomic and demographic conditions of the household. in particular the level of schooling and employment of the spouses. the size of the household. the marital status of the mother and the inter-birth space were recorded. The Complete Blood Count. the serum iron level and the thick blood test were carried out at the Saint Camille Biomedical Laboratory. The quality of children's dietary diversity was assessed through a 24-hour recall questionnaire. The different types of patient malnutrition were determined by calculating the main anthropometric indices based on the 2006 WHO standards [12]. Anemia was defined according to the concentration of Hemoglobin (Hb) and classified into anemic group (Hb < 11 g/dl) and non-anemic group (Hb ≥ 11 g/dl). The classification of anemia based on hemoglobin level was developed by WHO [13]. The mechanism of anemia was determined from erythrocyte constants. The Mean Corpuscular Volume (MCV) was considered normal when the value is between 75 and 85 fl. the normal value of the Mean Body Hemoglobin Concentration (MCHC) was between 32 and 36 g/dl and the serum iron level was normal for a value between 5.83 and 34.5 µmol/L. A thick blood test and Parasite Egg Cyst examination in stools were prescribed to the patients for the diagnosis of malaria and parasitic infections respectively.

Data analysis
Anthropometric indices were calculated using ENA Delta version 20 software to characterize types of malnutrition. Data were statistically processed using IBM SPSS version 20.0. A descriptive analysis was used to present the sociodemographic characteristics of children. parents. and households. Bivariate analyses were performed to explore the associations between anaemia. which is the dependent variable. and explanatory factors. using Pearson's chi-square test and relative risk. The significance threshold was set at $p < 0.05$ with a 95% confidence interval.

Ethical consideration
The study had obtained a favorable decision by deliberation number 2020-10-235 of the Ethics Committee for Health Research (CERS) of the Ministry of Health of Burkina Faso. The parents of children who met the inclusion criteria were informed of the objectives of the study. the conditions of participation. the procedure for clinical examinations and blood samples for biological examinations. Each parent gave informed consent before the administration of the questionnaires and various samples collection. Participation in the study was free. The confidentiality of the information was ensured by the codification of the data collection sheets and the analysis of these data was done anonymously.

Results
Sociodemographic and medical characteristics of the study population
A total of 139 malnourished children aged 06-59 months have been recruited. Male children were more represented 79 cases (56.8%) with a sex ratio of 1.31 boy/girl. The most represented age group was that of 06 to 23 months.131 cases (94.2%). The results showed that 79.1% of the children had acute malnutrition including 29.5% of severe cases. The patients' dietary diversity score revealed 69.1% of low dietary diversity score followed by a minimal diversity score of 30.9% (Table 1).

Table 1: Sociodemographic and medical characteristics of the malnourished children

Variable	Frequency	Percentage (%)
Sex		
Male	79	56.8
Female	60	43.2
Age (months)		
6-23	131	94.2
24-59	8	5.8
Birth weight (Kg)		
<2.499	28	20.1
≥2.5	111	79.9
Child rank in the siblings		
≥3	57	41.0
≤2	82	59.0
Mother education level		
Illiterate	32	23.0
Higher education level	33	23.7
Father's occupation		
Informal sector	76	54.7
Employee (public or private)	54	38.8
Underweight		
Underweight	87	62.6
Normal	52	37.4
Acute malnutrition		
Acute malnutrition	110	79.1
Normal	29	20.9
Serum iron level		
<Normal	50	36.0
Normal	89	64.0
Dietary diversity score		
Low dietary diversity score	96	69.1
Minimal dietary diversity score	43	30.9

Prevalence of anaemia

Out of a total of 139 malnourished children. 102 (73.4%) were anaemic. Among anaemic malnourished children. anaemia was moderate in 64 (46.0%) of the cases and severe in 2 (1.4%). Normochromic microcytic anaemia was predominant with 63 (45.3%) cases followed by normochromic normocytic anaemia in 46 (33.1%) cases (Table 2).

Table 2: Distribution of patients according to anaemia

Variable	Frequency	Percentage (%)
Anaemia		
Severe anaemia	2	1.4
Moderate anaemia	64	46.0
Mild anaemia	36	25.9
Non anaemic	37	26.6
Type of anaemia		
Normocytic normochromic	46	33.1
Normocytic hypochromic	6	4.3
Normochomic microcytic	63	45.3
Hypochromic microcytic	24	17.3

The child's birth order among siblings was a factor associated with the occurrence of anaemia (p=0.044; OR=2.31. 95% CI: (1.01-5.26)]. The mothers' level of education was a factor associated with the occurrence of anaemia. with malnourished children of mothers who had not attended school being 3.50 times more likely to be anaemic (p=0.046; OR=3.50. 95% CI: (0.98-12.50)]. The father's occupation was associated with anaemia. with children from families where the father worked in the informal sector 2.60 times more likely to be anaemic than children of salaried parents [(p=0.017; OR=2.60. 95% CI: (1.17-5.81)]. A significant association was observed between children who were underweight and the occurrence of anaemia; children who were underweight were 3.52 times more likely to be anaemic (p=0.001; OR=3.52. 95% CI: (1.61-7.70)]. Serum iron levels were associated with anaemia. with malnourished children with lower serum iron levels 3.13 times more likely to be anaemic [(p=0.012; OR=3.13. 95% CI: (1.25-7.77)]. Low dietary diversity score was a factor associated with the occurrence of anaemia [(p = 0.021. OR=2.48. 95% CI: (1.13-5.45)]. Children suffering from acute malnutrition were 2.40 times more likely to be anaemic [(p=0.043; OR=2.40. 95% CI: (1.01-5.69))]. No significant association was observed between the occurrence of anaemia and the age of the children (Table 3).

Table 3: Sociodemographic and medical factors associated with the occurrence of anaemia

Variables	Anaemicn (%)	Non naemicn (%)	p	OR (IC95%)
Age (months)				
06-23	98 (74,8)	33 (25,2)	0,123	2,97(0,70-12,55)
24-59	4 (50,0)	4 (50,0)		
Child rank				
≥ 3	47 (82,5)	10 (17,5)	0,044	2,31 (1,01-5,26)
≤ 2	55 (67,1)	27 (32,9)		
Mother education				
Not enrolled in school	28 (87,5)	4 (12,5)	0,046	3,50(0,98-12,50)
Superior	22 (66,7)	11 (33,3)		
Father's occupation				
Informal sector	62 (81,6)	14 (18,4)	0,017	2,60 (1,17-5,81)
Employee	34 (63,0)	20 (37,0)		
Underweight				
Underweight	72 (82,8)	15 (17,2)	0,001	3,52(1,61-7,70)
Normal	30 (57,7)	22 (42,3)		
Acute malnutrition				
Acute malnutrition	85 (77,3)	25 (22,7)	0,043	2,40 (1,01-5,69)
Normal	17 (58,6)	12 (41,4)		
Serum iron level				
<Normal	43 (86,0)	7 (14,0)	0,012	3,13 (1,25-7,77)
Normal	59 (66,3)	30 (33,7)		
Dietary diversity score				
Low	76 (79,2)	20 (20,8)	0,021	2,48 (1,13-5,45)
Minimal	26 (60,5)	17 (39,5)		

Discussion

The objective of this study was to determine the prevalence and potential factors associated with anemia in malnourished children aged 6 to 59 months. In this context. the prevalence of anemia was 73.4%. The study revealed that 94.2% of malnourished children were between 6 and 23 months old. This result is similar to that reported by Adebo *et al*. in Benin. where more than two-thirds of patients were under 24 months old [14]. This situation could be explained by the fact that children begin consuming complementary foods around six months of age. If these foods are not adapted to his nutritional needs. he becomes more

vulnerable to malnutrition. The proportion observed in our study is similar to that reported by Tshikonga *et al*. who reported a prevalence of 21.84% of acute malnutrition in the Democratic Republic of Congo when assessing the nutritional status of children aged 0 to 5 years [15]. This similarity could also be explained by the fact that the study was conducted in a hospital setting. where acute malnutrition was the most frequent type of malnutrition in the studied population.

The prevalence of anemia. as measured by hemoglobin levels in this study. was 73.4% among malnourished children. This prevalence was slightly lower than that reported by Sere *et al*. in children under five years of age. which was 87.6% (9). This result could be explained by the fact that malnutrition creates conditions favorable to the development of anemia. Indeed. in cases of malnutrition. the body's vital functions begin to deteriorate in order to adapt to minimal caloric intake. which slows the absorption of micronutrients? Among children suffering from both malnutrition and anemia. 66.7% had microcytic anemia and 33.3% had normocytic anemia. These proportions were similar to those reported by Adebo *et al*. in 2018 in Benin. which revealed 72.94% microcytic anemia and 25.29% normocytic anemia [14].

Microcytic anemia results from decreased hemoglobin production. primarily due to iron unavailability for hemoglobin synthesis. which could explain this finding. The study did not reveal macrocytic anemia in the patients. This study showed that 28.4% of patients had hypochromic anemia and 71.6% had normochromic anemia. This result is similar to that of Asobayire. who also showed that the rate of normochromic anemia (78.6%) was higher than that of hypochromic anemia in his study [16] The etiological approach to hypochromic anemia depends on the ferritin level and the transferrin saturation (siderophilin). The study revealed 64.7% normochromic microcytic anemia and 85.3% normochromic normocytic anemia. These proportions are higher than those obtained in Bamako. which were 19.5% for microcytic normochromic anemia and 8.4% for normocytic normochromic anemia [17]. These results could be explained by the fact that in young children. once the iron reserves acquired at birth are depleted. their iron status then depends on complementary foods [18]. Unfortunately. in our current development context. some traditional complementary foods would be poor sources of bioavailable iron.

The prevalence of anemia was higher in children born third or higher (82.5%) compared to those born before the third birth order (67.1%). A significant association was observed between birth order and the occurrence of anemia (p = 0.044). with a 2.31-fold higher risk in children born third or higher. This finding is consistent with that of Ngnie Teta *et al*. in Benin. who also demonstrated a significant association (p = 0.002) between birth order and anemia. Their study showed that the prevalence increased with birth order. rising from 77% in firstborns to 87% in children born after the fifth. The mother's level of education was significantly associated with the occurrence of anemia. Children of mothers with no formal education were at higher risk of anemia than those whose mothers had a university education. The higher the mother's level of education. the lower the prevalence of anemia. This finding is consistent with that of Ndour *et al*. in Senegal. who also highlighted this association [19]. They concluded that the mother's level of education appeared to influence food choices for the family. hygiene. and access to safe drinking water. which could affect children's nutritional status and lead to anemia. Furthermore. educated women were more likely to consult a doctor. have their children vaccinated. and seek treatment at appropriate health centers. The likelihood of a mother finding well-paid employment could increase with her level of education and. consequently. improve her access to foods rich in iron (meat) and vitamin C (fruit).

Children from families where the father is permanently employed in the informal sector were more likely to be anemic compared to children whose father is a salaried worker. A study on the factors contributing to anemia aggregation in households in Cameroon also revealed a significant relationship between the prevalence of anemia in children from middle- and low-socioeconomic communities and that in children from high-socioeconomic communities [21]. In general. in the African context. most households are headed by men. and their economic status determines food availability and living conditions. which could explain these results. A financially independent father is better able to provide quality care for his wife and children than a father with limited resources.

Underweight and acute malnutrition were significantly associated with the occurrence of anemia. This finding is similar to that of Ngnie Teta *et al*. who showed that underweight and acute malnutrition were significantly linked to the development of anemia in children in Mali and Benin [20]. Some studies on the interaction between nutrition. infections. and immunity have demonstrated that malnutrition impairs the body's resistance to infections. while infections cause or exacerbate malnutrition [22]. Malnutrition may reduce appetite or the ability to digest certain foods. which could increase the occurrence of anemia.

Serum iron levels are a statistically significant factor associated with the occurrence of anemia in the studied population. Children with below-normal serum iron levels were 3.13 times more likely to be anemic than those with normal levels. A similar study on serum iron concentration during periods of malnutrition in children in the Democratic Republic of Congo reported a high rate of 93.4% [23]. The detrimental state of the child's body due to malnutrition promotes the development of anemia.

Dietary diversity score is a potential factor associated with the occurrence of anemia in this study. Malnourished children with low dietary diversity were more likely to be anemic compared to malnourished children with minimal dietary diversity. The majority of children surveyed had a diet high in grains and very low in protein and bioavailable heme iron (meat. fish. eggs. etc.). insufficient to meet all nutritional needs. Plant-based foods are characterized by their low iron content and are often implicated in iron deficiency anemia [24]. Several factors impair the absorption of non-heme iron. including hemicellulose derivatives. pectin. phytic acid. and tannins [25]. Conversely. ascorbic acid. animal products. and fermented foods increase the bioavailability of non-heme iron. This is why the WHO recommends consuming at least 25 mg of vitamin C with each meal [26].

Limitations of the study
This study has some limitations. Firstly. ferritin measurement and electrophoresis could not be performed.

which limits the exploration of the biological causes of the anemia. Secondly. the scarcity of similar studies in Burkina Faso makes comparisons difficult.

Conclusion

The prevalence of anemia was high among malnourished children in this study. Potential factors associated with anemia included birth order. maternal education level. paternal occupation. underweight. acute malnutrition. low serum iron levels. and dietary diversity score. The data from this study reinforce the need for nutritional education in households and an intervention strategy focused on the nutritional management of malnourished children. which can be complicated by anemia.

Authors' contributions

MS and PAN designed and conducted the study. MS participated in data collection. MS and OO participated in data analysis and interpretation. MS drafted the manuscript. PAN and FWD provided critical revisions to the article. The final manuscript was approved by PAN and JS. All authors read and approved the final manuscript as submitted.

Competing interests

The authors declare that they have no competing interests

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