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Pilot Study of the Use of a Mother-Infant Double-Sided Mid-Upper Arm Circumference Bracelet at the Yalgado Ouédraogo University Hospital

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Abstract

Introduction: A continuum of quality care for the mother-infant pair at risk within the health and nutrition systems is important. The objective of this study was to evaluate the nutritional status of mother-infants with a prototype of a mother-infant double-sided mid-upper arm circumference (MUAC) bracelet in preparation to the integration of this strategy during the revision of the protocol for the prevention and management of malnutrition in Burkina Faso. **Patients and Methods:** This was a cross-sectional study conducted from July 2024 to January 2025 including infants aged six weeks to six months and their mother in the pediatrics department of the CHUYO. The anthropometry of the mother-infant pair was determined using the prototype double-sided MUAC measurement bracelet and standard criteria. **Results:** A total of 417 mother-infants were included. The MUAC with the prototype mother-child double-sided bracelet was less than 110 mm in 15.59% of infants and less than 230 mm in 6.47% of mothers. Growth retardation, underweight and wasting were 23.74%, 20.87% and 28.50% respectively in infants. Among mothers, 18.23% were obese, 21.58% were overweight, and 7.43% were thin. **Conclusion:** The double-sided MUAC measurement bracelet could identify children at risk of malnutrition and their mothers, improving early detection and care.

Keywords

Pilot Study, Double-Sided MUAC Bracelet, Mother-Infant, CHUYO

1. Introduction

In 2023, the World Food Security and Nutrition Report estimated between 691 million and 783 million people who suffered from hunger in 2022 [1]. According to the WHO, child undernutrition is a public health issue. In 2022, it was estimated that globally 149 million children under 5 years of age were stunted, 45 million were wasted [2]. Infants under 6 months of age are the most affected [3]. Many infants under 6 months of age in Low- and middle-income countries are at risk of stunting and development: about 10.3 million worldwide are underweight; 9.2 million are wasted, 11.8 million are stunted, and 8.9 million are low birth weight [4]. Undernutrition plays a role in nearly half of all deaths among children under 5 years of age. These deaths occur mainly in low- and middle-income countries [2] [5].

In Burkina Faso, the nutritional situation is characterized by the persistence of malnutrition in all its forms. The prevalence of wasting and nutritional oedema was 9.7%, chronic undernutrition was 21.6% and underweight was 17.5% in children under 5 years of age [6]. The national protocol for the integrated management of acute malnutrition (PCIMA) treats infants under 6 months of age in hospitalization [7]. A key aspect of the World Health Organization (WHO) guidelines for the prevention and management of wasting and nutritional oedema is the emphasis that mothers and infants are seen as an interdependent couple, whose health and well-being are intimately linked, and that any assessment of one must also involve an assessment of the other [8]. Infants younger than 6 months of age with the highest risk of death are better targeted by the use of mid-upper arm circumference (MUAC) [9]-[11]. The United Nations Children's Fund (UNICEF) has introduced a prototype of a double-sided mother-infant bracelet that can take measurements of both mothers and their infants [11]-[13]. The aim of this pilot study was to assess the nutritional status of mother-infants with the prototype of a double-sided MUAC measurement bracelet in preparation for the integration of this strategy during the revision of the protocol for the prevention and management of malnutrition in Burkina Faso.

2. Patients and Methods

2.1. Scope of the Study

The Yalgado Ouédraogo University Hospital represents the last reference level and is the largest health facility in Burkina Faso. It includes medical and medical specialties departments including pediatrics, surgery and surgical specialties including a gynecology and obstetrics department. The Paediatrics Department is our study site with the Paediatric Emergency Units, General Paediatrics, Neonatology, Paediatric Oncology and the Nutrition and Vaccination Unit. Data collection took place in these inpatient or outpatient units. The gynecology and obstetrics department provides family planning, maternal, newborn and child health care.

2.2. Period and Type of Study

It was a cross-sectional study with prospective data collection conducted over a period from October 15, 2024 to April 14, 2025.

2.3. Study Population

Mother-infants aged six weeks to six months in outpatient or inpatient paediatric department of the CHUYO were included. Infants in vital distress were not included in the study. The study was part of a research project on the acceptability by mothers and health workers of the use of a prototype mother-infant double-sided mid-upper arm circumference bracelet (**Figure 1**).

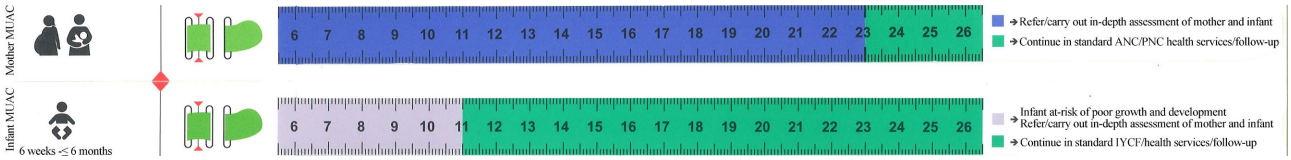

Figure 1. Prototype of a mother-infant double-sided mid-upper arm circumference bracelet.

2.4. Data Collection Technique and Tools

Socio-demographic data were collected using a structured questionnaire. Any mother who came to see a qualifying and consenting infant between six weeks and six months was included for six months. The 24-hour recall method was used to collect information on mothers' diets. Food security was assessed with the Access Scale for Household Food Insecurity (EAIAM) [14]. Anthropometric data from the mother and infant and clinical data from the child were collected using the KoboCollect app (version 2022.3.6). The data collection was preceded by the training of health workers in the use of the prototype of a double-sided mother-infant MUAC bracelet. The anthropometric equipment consisted of a baby scale, a scale, a stadiometer, the adult MUAC measuring tape, the prototype of a double-sided mother-infant measuring tape. Standard anthropometric indicators were calculated and compared to baseline data from the WHO growth chart 2006 [15]. Thus, for infants, the nutritional status was assessed by the Weight-for-age Z-score < −2 SD (underweight); or weight-for-length Z-score < −2 SD (wasting); or height-for-age Z-score < −2 SD (stunting); or Nutritional edema; or MUAC < 110 mm for infants aged 6 weeks to less than 6 months. The mothers nutritional status was assessed by the MUAC < 230 mm for thinness, and the body mass index (thinness for a body mass index [BMI] < 18.5 kg/m^2, normal nutritional status for a BMI between 18.5 kg/m^2 and 24.99 kg/m^2, overweight for a BMI between 25 and 30 kg/m^2, obesity for a BMI > 30 kg/m^2).

2.5. Data Processing and Analysis

Statistical analyses were performed using IBM SPSS Statistics version 26. The qualitative variables were described by their number and percentage; quantitative variables by their mean and standard deviation.

2.6. Ethical and Deontological Considerations

The study obtained the favorable opinion of the general management of the CHUYO and the National Ethics Committee of Burkina Faso and allocated the reference number 2024-07-225. The mother's consent was required, and the confidentiality of the data was respected.

3. Results

3.1. Socioeconomic and Demographic Characteristics of Mothers and Infants

Over the six-month period, 417 mother-infants were included. The mean age of mothers was 28.23 years (±6.60) and that of infants was 2.87 (±1.48 months). The male sex represented 50.12%. Table 1 presents the socio-economic and demographic characteristics of mothers and infants.

Table 1. Distribution by socioeconomic and demographic characteristics of mothers and infants in CHUYO.

Variables	Frequency	Percentage
Age of mothers (years)		
]17 - 25]	136	32.61
]25 - 34]	193	46.27
]35 - 44]	88	21.12
Age of infants (months)		
≤ 2	96	23.02
3 to 4	168	40.29
5 to 6	153	36.69
Infant gender		
Male	209	50.12
Female	208	49.88
Residential setting		
Urban	397	95.20
Rural	20	4.80
Marital status		
Married/living as a couple	380	91.12
Bachelor/single	37	8.87
Parent education level		
Secondary	138	33.09
None	118	28.30
Primary	101	24.22
Upper	60	14.39

Continued

Father's level of education		
None	121	29.02
Primary	113	27.10
Secondary	102	24.46
Upper	81	19.42
Profession		
Housewife	168	40.29
Informal sector	134	32.13
Merchant	77	18.47
Employee	38	9.11
Father's profession		
Informal sector	177	42.45
Merchant	98	23.51
Employee	93	22.30
Farmer	49	11.75

3.2. Nutritional Status of Mothers and Infants from Six Weeks to Six Months

The MUAC with the double-sided bracelet prototype was less than 110 mm in 15.59% of infants and less than 230 mm in 6.47% of mothers. Stunting, underweight and wasting were 23.74%, 20.87% and 28.49% respectively in infants. Among the mothers, 18.23% were obese, 21.58% were overweight, and 7.43% were thin (Table 2).

Table 2. Anthropometric parameters of infants and mothers at the CHUYO.

Anthropometric parameters	Frequency	%
Child's MUAC (mm)		
<110	65	15.59
≥110	352	84.42
Mother's BMI		
<18.5	31	7.43
18.5 - 24.9	220	52.76
25 - 29.9	90	21.58
≥30	76	18.23
Mother's MUAC (mm)		
<230	27	6.47
≥230	390	93.53
Weight-for-Length Ratio		
<−3 Z-Score	49	11.93
<−2 Z-Score	68	16.57
≥−2 Z-Score	282	71.60

Continued

Height -for-age ratio		
<−3 Z-Score	32	7.67
<−2 Z-Score	67	16.07
≥−2 Z-Score	318	76.27
Weight−for−age ratio		
<−3 Z-Score	26	6.24
<−2 Z-Score	61	14.63
≥−2 Z-Score	330	79.13

3.3. Clinical and Dietary Characteristics of Mothers and Infants

Overall, 19.38% of the mothers had received more than four antenatal care visits. They were primiparous in 34.53%, and pauciparous in 49.40% of cases. Feeding practices noted a good minimum frequency of meals in 82.97% and a good minimum dietary diversity in 39.81% of cases. Infants had a birth weight < 2500 g in 50.60%, the Apgar score at the first and fifth minute was 85.61% and 98.56% respectively. For feeding practices, early initiation of breastfeeding was 73.14%, consumption of colostrum in 95.43% of cases and exclusive breastfeeding in 78.66% of cases. The causes of non-exclusive breastfeeding were difficulties related to the mother: lack of breast milk (56.76%), difficulty breastfeeding (43.82%), return to work (21.35%), maternal illness (18.92%). Difficulties related to infants were vomiting/regurgitation (40.62%), refusal to suckle 34.38%, digestive disorders 12.50%. Respiratory infections accounted for 34.8%, diarrhoea for 23.7%, fever or malaria for 21.2% of cases and nutritional oedema for 0.72% of cases. Table 3 presents infant and maternal feeding practices at CHUYO.

Table 3. Infant and maternal feeding practices at CHUYO.

Feeding practices	Frequency	Percentage (%)
Infants		
Early initiation (<1 h)		
Yes	305	73.14
No	112	26.86
Colostrum at birth		
Yes	398	95.43
No	19	4.57
Exclusive breastfeeding		
Yes	328	78.66
No	89	21.34
Breastmilk Substitute		
Yes	37	8.87
No	380	91.13

Continued

Mixed breastfeeding		
Yes	42	10.07
No	375	89.93
Feeding difficulties		
Yes	32	7.67
No	385	92.33
Mothers		
Minimum frequency of meals		
Not met	71	17.03
Respected	346	82.97
Minimal dietary diversity		
No	251	60.19
Yes	166	39.81
Food safety level		
Food security	225	53.96
Mild/moderate food insecurity	47	11.27
Severe food insecurity	145	34.77

4. Discussion

During six months, we collected 417 mothers and infants who came to the center for consultation or hospitalization.

The MUAC with the prototype mother-infant double-sided measurement bracelet was less than 110 mm in 15.59%, the weight-for-height ratio < −3 Z-score for 11.93% in infants. For mothers, the MUAC was less than 230 mm in 6.47% and the BMI < 18.5 in 7.43%. In Kenya, a MUAC < 110 mm occurred in 19% of infants [11]. However, to our knowledge, the relevant published data allowing a meaningful comparison with the results of this study are almost non-existent since the MUAC threshold was not homogeneous before the WHO recommendations in 2023. These MUAC thresholds varied between 105 mm and 125 mm depending on the study [10] [11] [16] [17]. By comparing the MUAC as a screening and diagnostic tool for children at risk of growth or developmental disorders to current standards, it allows more infants to be included in the program with the implications that this will have on care [13] [17].

The updated WHO guidelines has provided, in addition to the specific anthropometric criteria in the list of criteria used to identify infants at risk of poor growth and development, other criteria such as infants with low growth on the basis of sequential measurements, infants with known risk factors for poor growth and development or infants at risk due to poor birth outcomes (preterm birth or low birth weight) [8]. This will therefore make it possible to widen the threshold of infants concerned in the center. This will require the organization of screening,

inpatient or outpatient care in the center that is not taken into account in the old recommendation [7] [8] [19].

An infant's well-being is intimately linked to that of his mother, as is his care. Vulnerable infants under six months of age should receive comprehensive, person-centered care for them and their mothers [13] [20]-[22]. The screening rate with the prototype of a double-sided mother-infant bracelet is close to that of BMI. Higher rates have been found in other studies [23] These mothers, who are themselves vulnerable, must be cared for with the infant as an interdependent unit. This request for care can concern their physical, mental or social health. In addition, a comprehensive assessment of breastfeeding and subsequent support for the health and well-being of the infant and his/her mother must be done. In our case, early breastfeeding and exclusive breastfeeding were practiced in 73; 14% and 78.66% respectively, which was close to the national rate of the SMART nutrition survey at 97.6% and 77.50% but higher than the rate of Cissouma *et al.* in Mali which had a rate of 38.10% and 17.46% respectively [6] [24]. In fact, this involves establishing close linkages with antenatal and postnatal care services, sexual and reproductive health services (such as family planning), and other preventive and curative services where women and children are in contact with health workers (e.g., for immunization, growth monitoring, psychological services) [3] [8]. Our center, due to its tertiary level in the health pyramid of our country, has various services that could ensure the integrated care of mothers and children in an integration that allows us to provide a complete package of health services and support to women and children. There is a need to provide holistic care accounting for the expressed and unexpressed needs of the mother-child pair at the points of contact which involves multiple disciplines and actors in health, nutrition and social services [20].

Studies show that the mid-upper arm circumference is recognized as an instrument that can best target the risk of death in the population [10] [16] [18] [19]. It appears to be a tool that can be easily adopted for infants and their mothers/guardians. The advantage of inclusion based on the MUAC is simple, convenient and easy to use for both health professionals and mothers [18] [25] [26]. This confirms that the prototype can improve screening for mothers-infant and their care in our healthcare facilities, hence the importance of its acceptability by mothers and healthcare workers.

The study should be interpreted considering some limitations. The results are not representative of the national population. However, it has the merit of having been the pilot study using this prototype of a mother-infant double-sided mid-upper arm circumference bracelet.

5. Conclusion

The rate of children at risk of growth disorders or poor development was high at the CHUYO. The prototype of a double-sided mother-infant bracelet for measuring MUAC could identify vulnerable children and their mothers. CHUYO could

provide integrated care for mothers and children in an integrated manner that would provide a comprehensive package of health and support services to women and children. It is up to the center to anticipate the involvement in terms of organization to provide this integrated care for the implementation of the Protocol for the Prevention and Management of Malnutrition currently being revised to take into account updates to WHO guidelines. The introduction of the double-sided mother-infant measurement bracelet at the primary care and community levels could complement this study.

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Conflicts of Interest

The authors declare no conflicts of interest regarding this manuscript.

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