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Determinants of the Brachial Perimeter in the Management of Acute Malnutrition at the Ureni of Kayes in 2019

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Abstract

Introduction: Malnutrition is a public health problem in Mali. It is one of the major causes of morbidity and mortality in children under five years of age [1]. The management of acute malnutrition at the level of the different units and its screening at the community level use the brachial perimeter (BP). In health centers, the weight/height index is the most commonly used to determine acute malnutrition [2]. The present study examines PB and its determinants at the URENI of the CSRéf of Kayes. It aims to analyze the PB, to provide providers of acute malnutrition management units with updated data on the links between the PB variable and other variables in order to contribute to the improvement of acute malnutrition treatment.

Methods: descriptive, cross-sectional and retrospective study of 400 records of children hospitalized at the URENI of the CSRéf of Kayes in 2019.

Results: Of all the SAM patients, only 57% had a SAM PB. The PB measure was less predictive of SAM than the W/S index. Statistically significant associations were observed between PB and W/S index; PB and underweight.

Discussion: The average PB was 108.6 mm. A study performed in CSRéf de Nara (Koulikoro region, Mali) in 2016 had found a mean PB at 105 mm [3]. In our study, 57% of the sample had a PB SAM and 95.5% had a W/SSAM ratio. This observation is similar to that of Sidibé M. during his study at the URENI of the CSRéf of Kalaban in 2018 [4].

Keywords: URENI, Brachial perimeter, Malnutrition, Kayes.

Introduction

In Mali, malnutrition is a public health problem, as it is in most countries of sub-Saharan Africa. It is one of the major causes of morbidity and mortality in children under five. In 2019, the prevalence of global acute malnutrition (GAM) was 9.4%. That of chronic malnutrition (CM) and underweight (UW) was 26.6% and 18.1% respectively [1].

The Kayes region composed of 10 health districts, including the Kayes circle, has experienced a favorable evolution of indicators for the management of acute malnutrition. In 2017, the GAM

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was at 14.2% to be at 8.9% in 2019. The PI has evolved between 18.3% and 14.3% during the same period. Stunting has evolved between 20% and 19.7% [1].

As for the Kayes health district, it covers 52 functional urenam (moderate ambulatory nutritional recovery and education unit) and urenas (severe ambulatory nutritional recovery and education unit) as well as two URENI (intensive nutritional recovery and education units at the Kayes reference health center (CSRéf) and the Alfouseni Dao hospital in Kayes).

The management of acute malnutrition in the various units and its screening at the community level (CHWs, community relays, GSAN) use the brachial perimeter (BP) of patients. In fact, according to the national PCIMA protocol, patients (6- 59 months) who have a PB lower than 115 mm are considered to be severely acutely malnourished. If the PB is ≥ 115 mm and < 125 mm; the patient is considered to be doing moderate acute malnutrition. For a PB greater than or equal to 125 mm; the nutritional status compared to acute malnutrition is considered good. It should be noted that if in the health centers, the weight/height ratio index is used to determine nutritional status;

In the community, the PB remains the most used measure to determine acute malnutrition (AM) whether it is the CHWs (screening and management) or the community relays and GSAN (nutrition activities support group) [2].

The present study examines PB and its determinants at the URENI of the CSRéf of Kayes in 2019. It aims to analyze the PB, to provide providers of acute malnutrition management units with updated data on the links between the PB variable and other variables in order to contribute to the improvement of acute malnutrition treatment.

Objectives

General objective

To identify the determinants of PB in the management of acute malnutrition in patients hospitalized at the URENI of the CSRéf of Kayes in 2019.

Specific objectives

- Characterize the PB of patients hospitalized at the URENI of the CSRéf in 2019.
- Identify the determinants of PB at the URENI of the CSRéf in 2019.

Methodology

Study setting: URENI of the CSRéf of Kayes.

Type of study: cross-sectional and retrospective descriptive study.

Study period: the study concerned the year 2019.

Inclusion criteria: patients between 6 and 59 months of age, hospitalized at the URENI of the CSRéf in 2019 whose follow-up records were found and entered into the database.

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No-inclusion criteria: patients less than 6 months of age hospitalized in the URENI of the CSRéf, patients older than 6-59 months whose follow-up records were not found. Patients hospitalized out side the study period or older than 59 months.

Sample: the study involved 400 patients hospitalized at the URENI of the CSRéf in 2019.

Process: the records of the hospitalized patients were exploited through the collection of data in a data entry SAM. The records for the months of October and November could not be retrieved. Data collection and analysis were carried out by SPSS statistics 21. In fact, 401 records were entered. Due to an outlier PB, the records analyzed were 400.

Results

Brachial Perimeter (BP)

Table 1: Distribution of patients according to PB

Brachial Perimeter (BP)	PB Numbers	Percentage
PB SAM (70 – 114)	229	57,25
PB MAM (115 – 124)	136	34
PB Normal (125 – 140)	35	8,75
Total	400	100

The minimum PB was 70 mm and the maximum was 140. The most frequent PB was 110 mm (23.7%) followed by PB at 115 mm (13%) and 120 mm (13%).

The majority of patients (57%) had a SAM PB (70 -114 mm); 34% had a MAM PB (115-124mm) and 9% had a normal PB (125 - 140 mm). The average PB was 108.6 mm.

Weight/Size Ratio (W/S)

Table 2: Distribution of patients according to weight for size index

Weight/Size Ratio	Number	Percentage
< -3 Z-score	382	95,5
≥-3 ET < -2 Z-score	18	4,5
Total	400	100

The majority of patients (95.5%) had a W/SSAM index (less than -3 Z-scores); 4.5% had a W/S MAM index (Z-score between -3 and -2) and no patients had a normal W/S index.
These data show that the proportion of severe acute malnourished detected by the W/S index is higher than that detected by the brachial circumference measurement.

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BP and weight/size index (W/H)

Table 3: Distribution according to PB and weight/height index

	< - 3 Z-score		between -2 and - 3 Z-score	
PB	Number	Percentage	Number	Percentage
PB SAM (70 – 114 mm)	227	59	2	11
PB MAM (115 – 124 mm)	125	33	11	61
PB Normal (125 – 140 mm)	30	8	5	28
Totals	382	100	18	100

Among patients with a W/SSAM index (382), only 59% had a SAM PB; 33% had a MAM PB and 8% had a Normal PB.

Among the patients with a W/S MAM index, 11% had a PB SAM, 61% had a PB MAM; 28% had a PB Normal.

It should be noted that 2 out of 18 patients screened for MAM through the W/S index had a PB SAM.

The screening capacity for severe acute malnutrition by the W/S index was 99.5% (Total DSS screened by the W/S index out of the total screened by the W/S index and the PB). The concordance rate for the PB was 60% (Total SAMs screened by the W/S index out of the total screened by the W/S index and the PB).

The concordance rate between the PB and the W/S index in SAM screening (i.e., the number of patients screened for SAM simultaneously by both measures, divided by the total number of SAMs) was 59%.

The screening capacity for moderate acute malnutrition by the W/S index was 89%. That of the PB was 61% (same formula for SAM screening).

The concordance rate between the PB and the W/S index in screening for moderate acute malnutrition (i.e., the number of patients screened for SAM simultaneously by both measures divided by the total number of SAMs) was 61%.

The concordance rate between the PB and the W/S index in the detection of acute malnutrition was 91.2%.

A statistically significant relationship was found between brachial circumference and W/S index (Chi2: 73.72; P= 0.02).

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Normal PB, age and W/S index

For SAM children (Z-score < 3) 6 to 23 months of age with normal PB; 67% had PB at 125 mm, 22% had PB at 130 mm. Those with PB at 126, 127 mm each accounted for 6%. No patient in this group had a PB of 135 mm or more.

For patients with ages between 6 - 23 months with a W/S MAM index (≥ -3 Z-score < - 2 Z-score), 50% had a PB at 125 mm, 25% had a PB at 126 mm and 135 mm, respectively. Those with PB at 127, 130 mm each accounted for 0%.

Of the total children aged 6 - 23 months who were malnourished (total SAM + MAM) with a PB of 125 mm, 86% were SAM and 14% were MAM. For those with a PB of 126, 50% were SAM, 50% MAM. For those with PB 127, 130 mm; all were SAM. The one with a PB of 135 was MAM.

Patients aged 6-23 months with a normal PB (125-135 mm) all had a malnutrition W/S index, of which a large majority (81%) were severely acutely malnourished.

For patients 24 - 59 months with a SAMW/S index (< - 3 Z-score); 58% had a PB of 125 mm, 8% had a PB of 128 mm and 135 mm, 25% had a PB of 130 mm. No patient in this group had a PB of 140 mm.

Only one patient in the 24 - 59 month age range with a W/S MAM index (≥ -3 Z-score < - 2 Z-score) had a PB at 140 mm. None of the patients in this group had a PB between 125 and 135 mm.

Children 24 - 59 months of age who were acutely malnourished (Total SAM + MAM) with a PB of 125 mm to 135 mm, were all SAM (100%) according to the W/S index. The one with a PB of 140 mm was MAM.

Patients aged 24-59 months who were hospitalized with a normal PB (125-140 mm) all had a W/S index of malnourished, of which a large majority (92.3%) were severely acutely malnourished.

In the 6-59 month age group, among patients with a SAM W/S index; 53% had a PB of 125 mm; those with PB of 126 mm, and 127 mm each accounted for 3%. Within this group, those with PB at 128 mm and 130 mm each accounted for 19%. No patient in this group had a PB of 140.

In the 6-59 month age group, among patients with a MAM W/S index; 40% had a PB of 125 mm; those with PBs of 126 mm, 135 mm, and 140 mm each accounted for 20%. Within this group, those with PB at 127 mm, 128 mm, and 130 mm each accounted for 0%.

Of the patients aged 6-59 months who were acutely malnourished (total SAM + MAM) with a PB of 125 mm, 90% were SAM and 10% were MAM. Those with a PB of 126 mm, and 136 mm; 50% were SAM, 50% MAM. For those with PB 127mm, 128mm, 130 mm; all were SAM. The one with a PB of 140 was MAM.

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The 6-59 month old hospitalized patients who had a normal PB (125-140 mm) all had an acute malnutrition W/S index of which a large majority (88%) were SAM. And 12% were MAM.

PB, W/S Index and Edema

Edematous patients accounted for 5.5% of the sample, or 22 patients. Mild edema (one-cross edema) was the most frequent with 3%, followed by severe edema (three-cross edema) with 1.5%; followed in turn by moderate edema (two-cross edema) with 1%.

Also, 58% of the patients with one-cross edema had a SAM PB and 42% had a MAM PB. 75% of those with two-crossed edema had a SAM PB and 25% had a MAM PB. 67% of patients with three-cross edema had a SAM PB; 16.6% had a MAM PB and the same number had a normal PB.

Of 35 patients with normal PB, only 1 case (3%) had three-cross edema.

Patients who presented SAM (SAMW/S index and/or SAM PB and/or presence of edema) represented 96.5% of the sample compared to 3.5% of MAM.

PB and chronic malnutrition

Among patients with SAM PB, 57% had chronic malnutrition (32% severe, 25% moderate) and 43% did not have chronic malnutrition.

Among patients with MAM PB, 33% had chronic malnutrition (10% severe; 23% moderate) and 67% did not have chronic malnutrition.

Among patients with normal BP, 23% had chronic malnutrition (11.43% severe; 11.43% moderate) and 77% did not have chronic malnutrition.

In the three previous BP ranges, it was observed that the rate of chronic malnutrition was inversely proportional to the BP. However, there was no statistically significant relationship between PB and chronic malnutrition.

PB and weight insufficiency (PI)

Among the patients with DSS PB, 97.8% had PI (83.3% severe and 14.5% moderate); and 2.2% had no PI.

Among patients with MAM PB, 90% had a PI (54% severe, 36% moderate) and 10% had no PI.

Among patients with normal BP, 83% had PI (37% severe; 46% moderate) and 17% had no PI.

In the three previous BP ranges, it was observed that the rate of PI was inversely proportional to BP. Also, there was a statistically significant relationship between LBP and underweight (Chi2: 139.4 P: 0.00).

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BP and Weight Gain

Individual weight gains ranged from 0 to 78.43 g/kg/d. The mean weight gain (MWG) was 18.04 g/kg/d for all successfully treated patients. Also, 16.2% of the admitted patients had an individual weight gain below 8 g/kg/d while for 84% it was above 8 g/kg/d.

For the patients whose weight gain was below 8 g/kg/d, 49% had a SAM PB; 34% had a MAM PB and 17% had a normal PB (125-140 mm). These observations show that almost 50% of the patients who had subnormal weight gain (≥8 g/kg/d) were of a SAM PB.

Patients with PB SAM had a MAM of 19.2 g/kg/d. Those with PB MAM had theirs at 16.5 g/kg/d. Finally, patients with normal PB had a MOC of 16.3 g/kg/d. These data show a trend of inverse proportionality between PB and average weight gain. However, the statistical test (Chi2) did not find a significant relationship between PB and weight gain.

PB and Average Length of Stay (ALOS)

It was found that the average length of stay varied very little with the PB. While it was 4.9 days for normal PB, it was 5 and 5.2 days respectively for SAM and MAM PB.

There was no statistically significant relationship between PB and length of stay.

PB and sex of patients

For the entire sample, the majority of patients were female (53.5%). Male patients accounted for 46.5%.

For patients with SAM PB, 56% were female and 44% male. For those with MAM PB, 51% were male and 49% were female. Patients with normal PB were predominantly female (51%) with 49% male.

The difference between the sexes for patients with MAM and normal PB seems slight. However, it appeared to be significant for patients with SAM PB.

No significant relationship was found between the PB and the sex of acute malnourished patients hospitalized at the URENI of the CSRéf of Kayes.

PB and type of discharge

Among patients with PB SAM, 94.8% were successfully treated. This rate was 94.9% for those with MAM PB, 97% for normal PB.
Discontinuations accounted for 0.7% in SAM PB, 0.9% in MAM PB and 3% in normal PB.

The death rate was 0.4% in SAM PBs, 0% in normal PBs. However, it was 0.7% in MAM PB.

There were no deaths from edema. However, three cases of edema were referred to the hospital (two cases of mild edema and one case of moderate edema). All three cases of edema had a PB MAM).

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Also 3.9% of the SAM PB were referred to the pediatric department of the regional hospital. This rate is 3.7% in MAM PB and 0% in normal PB.

It can be seen that the rates of successfully treated patients are almost similar among the different PB. However, there was a high dropout rate among patients with normal PB. The baseline rates were almost the same as SAM and MAM PB subjects; while it was 0% in normal PB subjects.

Discussion

The study involved 400 medical records of patients hospitalized at the URENI of the CSRéf of Kayes in 2019. Its limitation concerns the study setting (URENI) which generally receives cases of severe acute malnutrition with complications, limiting the extrapolation of the findings to other SAMs admitted to the urenas.
At the end of the study, the findings were as follows:

Brachial Perimeter

The most frequent PB was 110 mm and the majority of patients (57%) had a SAM PB (70 -114 mm). The average PB was 108.6 mm. A study performed at CSRéf de Nara (Koulikoro region, Mali) in 2016 had found a mean PB at 105 mm [3].

PB and W/S Index

In our study, 57% of the sample had a PB SAM and 95.5% had a W/SSAM ratio. This finding highlights a strong ability of the W/S index to detect SAM than PB. This observation is similar to that of Sidibé M. during his study at the Kalaban CSRéf URENI in 2018. He found that the proportions of SAM detected by PB were 53.4%; those detected by the W/Sindex were 80.9% [4]. A. Kaboré Ouedrago et al. in their study found 18.42% as the rate of severe acute malnutrition in a sample of 76 patients at the Charles de Gaulle University Hospital in Ouagadougou (Burkina Faso) based on the W/S index [5].

In the document WHO Growth Standards and Identification of Severe Acute Malnutrition in Children, it was reported that in an analysis of 560 nutritional surveys in 31 countries; the prevalence of children with a W/S index lower than -3 standard deviations (3.22%) and that of children with a PB lower than 115 mm (3.27%) were similar [6]. This finding is contrary to ours where the dissimilarity between the proportions was huge (it was 57% and 95.5% respectively).In two hospitals in Kenya, it is noticed that all participants were SAM per the WHO criteria (i.e., based on MUAC, WHZ, or edema) with 12%, 16%, and 17% of participants classified as SAM by MUAC alone, WHZ alone, and edema alone, respectively [7]

Elsewhere, our findings are in line with the different results of the SMART surveys conducted in Mali from 2011 to 2019, as the prevalences of SAMs screened by the W/S index were always higher than those screened by the PB [8].

Despite the disparity between the proportions of SAMs screened by PB and the W/S index, there was a statistically significant relationship between them.

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The discrepancies in concordance between the W/S ratio and the PB results for the detection of severe acute malnutrition remain a concern. In Mali, the measurement of the PB through the Shakir band remains the preferred means of screening for acute malnutrition in the community (active screening by community relays, support groups for nutrition activities, the mother PB strategy, tradithérapeute PB). Also, this measurement is used in health facilities and by community health workers in the screening, management and follow-up of malnourished children in the different programs. Our findings suggest that many cases of SAM are missed and do not receive adequate care. These children will be identified as MAM or as having good nutritional status through the measurement of PB. Moreover, during our study, it was found that a large majority (88%) of the patients (35) who had a normal PB (125 -140 mm) were SAM. More specifically, 90% of those with PB at 125 mm, 50% of those with PB at 126 and 136 mm; 100% of those with PB 127, 128 and 130 mm were all SAMs through the W/S ratio. In Kenya 64% of patients admitted in hospital had normal MUAC and 48% of them had normal WHZ [9]

In response to these findings, we asked a number of questions: was the significant discrepancy between the W/S index and the PB related to the study setting (URENI), to the lack of SAMtery of anthropometric measurement techniques by the agents in charge of this activity; was the situation the same in the URENAS and URENAM, and was it the same in community settings?

As for the lack of SAMtery of the anthropometric measurement technique, this can be minimized, since the said agents have been trained at least three times over the last three years on the protocol for the management of malnutrition. As for the other questions, we think that it would be better to continue our study in the outpatient Uren and in the community to study this phenomenon.

PB and edema

Edema cases accounted for 5.5% of the sample. And the majority of them were mild edema. The majority of the edematous patients had a PB SAM (63.63%). Dembélé I. et al had found 5.85% cases of Kwashiorkor [8]. This finding is similar to ours. Diall H. et al found 16.1% [11]. This result is much higher than ours. Diall H. et al had included more than 6000 children from 0 to 15 years old who consulted the pediatrics department of the CHU Gabriel TOURE in Mali. Whereas our study involved 400 cases and children aged 6 to 59 months hospitalized at the URENI of the CSRéf of Kayes.

Stunting and types of under nutrition

- **Stunting:** The proportion of stunted growth was 57% for patients with SAM, 33% for MAM and 23% for normal.

It was found that as PB increased, the proportion of stunted patients decreased (i.e., more stunting in SAM PB than in MAM PB; more stunting in MAM PB than in normal PB). There was no statistically significant relationship between PB and growth retardation.

- **PB and Ponderal Insufficiency (PI):** The proportion of PI was 97.8% for patients with SAM PB, 90% for MAM PB and 83% for normal PB.

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It was observed that the PB and the frequency of PI were inversely proportional (as the PB increased, fewer cases of PI were observed). A statistically significant relationship was observed between PB and PI.

- **PB and acute malnutrition:** In patients with W/S SAM, 59% of patients had SAM PB, 33% had MAM PB, and 8% had normal PB.

It was found that screening for acute malnutrition through the PB was less efficient than using the W/S index (SAM (PB: 59%, W/S: 100%); MAM (W/S: 100%, PB: 61%)).

These observations show that at the URENI, we are rarely dealing with only one type of under nutrition. All three types were present in almost half of the patients (45.5%). This once again calls on nutrition actors to redouble their efforts in the prevention and early detection of malnutrition through infant and young child feeding, preventive monitoring of children, and regular screening (active and passive) for acute malnutrition.

References

Retrospective National Nutritional Anthropometric and Mortality Survey following the SMART-2019 methodology, Mali. Final report. December 2019. P131.

Ministry of Health and Public Hygiene. Protocol for integrated management of acute malnutrition. Revised version 2017. P238.

F Traore, B Maiga, H Diall, S Sissoko, K Sacko, D Konaté et al. Management of acute malnutrition in children in a Sahelian secondary hospital. Mali médical 2020 tome xxxv n°2. 2020 ; P 32-37.

Sidibé M. Evaluation of the activity report of the URENI of the Reference Health Center of Kalaban Coro. Thèse de Médecine. 2019. P76.

A. Kaboré Ouédraogo, N L Sawadogo, H Savadogo, S Kabore, G Yaméogo, S Ilboudo, C Yonaba Okengo, Diarra Yé, et al. Nutritional status of children less than six months of age hospitalized at the Centre Hospitalier Universitaire Charles de Gaulle (CHUP-CDG) in Ouagadougou, Burkina Faso. Jaccr Africa 2020; 4(1): 1-10.

WHO, UNICEF. WHO growth standards and identification of severe acute malnutrition in children. Joint statement by the World Health Organization and the United Nations Children's Fund. P12.

B. Wen *et al.*, "Predicting the risk of mortality during hospitalization in sick severely malnourished children using daily evaluation of key clinical warning signs," *BMC Med.*, vol. 19, no. 1, 2021, doi: 10.1186/s12916-021-02074-6.

National Nutritional and Mortality Retrospective Survey following the SMART methodology-September 2019, Mali. P131.

M. K. Mwangome, G. Fegan, A. M. Prentice, and J. A. Berkley, "Are diagnostic criteria for acute malnutrition affected by hydration status in hospitalized children? A repeated measures study," *Nutr. J.*, vol. 10, no. 1, 2011, doi: 10.1186/1475-2891-10-92

Dembélé I, Sogodogo S, Kayembé K, Sangho O, Coulibaly CA, Telly N et al. Determinants of severe acute malnutrition with complications in children under 5 years of age in the

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health district of Banamba, Mali, 2014-2018.Mali Santé Publique 2019. Volume IX N°002. P 14 - 17.

Diall H, Bathily S, Sylla M, Coulibaly O, Maiga B, Traoré F, et al. Prevalence of malnutrition among children hospitalized in the Pediatrics Department of CHU Gabriel Touré (Bamako) from May 2011 to April 2012. Mali santé Publique 2018. Volume VIII N°001. P 22 - 24.