

# WHZ and MUAC Overlap but Identify Different Children As Acutely Malnourished, and Diagnosis is Sensitive to Child Sex: Insights From Burkina Faso and Sierra Leone



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## Background & Objective

- Mid-upper arm circumference (MUAC) and weight-for-height z-scores are two anthropometric measures frequently used to identify acutely malnourished children. WHO (2013) recommends the use of MUAC or WHZ to identify wasted children between the age of 6-59 months.
- However, previous literatures comparing MUAC and WHZ demonstrates that they identify different children as wasted children and the discrepancy between the two indicators varies across different settings (Zaba, Nyawo & Alvarez Moran, 2020; Grellety & Golden, 2016; Lailou et al, 2013). Moreover, the differences of MUAC and WHZ in identifying wasted children by sex are scant (Tadesse et al., 2017), all of which can impact the quality of programs.
- We compared the extent to which MUAC and WHZ identify the same children as moderately and severely acutely malnourished (MAM and SAM) using data from FAQR studies in Burkina Faso and Sierra Leone.

## Methods

- Severe acute malnutrition (SAM) was defined as MUAC < 11.5cm or WHZ < -3SD; MAM was defined as 11.5 < MUAC < 12.5cm or -3SD < WHZ < -2SD.
- We calculated Spearman's coefficient of correlation at each visit to test the strength of association. Then, we calculated Cohen's Kappa coefficient (k) stratified by sex and age group to observe the agreement between the two measures. Lastly, sensitivity and specificity analyses on diagnosing MAM and SAM children for each visit were conducted.

## Findings

### Burkina Faso

Figure 1: Spearman's coefficient of correlation between MUAC and WHZ by each visit and sex, Burkina Faso, 2014-2016

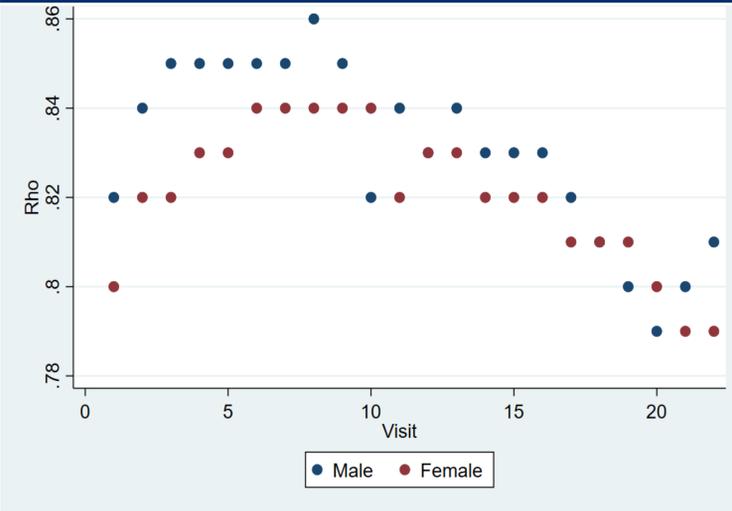


Table 1: Cohen's kappa coefficient (k) for MUAC and WHZ in diagnosing SAM and MAM by sex Burkina Faso, 2014-2016

	WHZ MAM	WHZ SAM	TOTAL
All Children		k = 0.20	
MUAC MAM	3796	1137	4933
MUAC SAM	167	286	453
TOTAL	3963	1423	5386
Male		k = 0.16	
MUAC MAM	1691	799	2490
MUAC SAM	37	140	177
TOTAL	1728	939	2667
Female		k = 0.29	
MUAC MAM	2105	338	2443
MUAC SAM	130	146	276
TOTAL	2235	484	2719

Note: SAM: Severe Acute Malnutrition; MUAC: mid-upper arm circumference; WHZ: weight-for-height z-score; MAM = moderate acute malnutrition.

### Sierra Leone

Figure 2: Spearman's coefficient of correlation between MUAC and WHZ by each visit and sex, Sierra Leone, 2014-2016

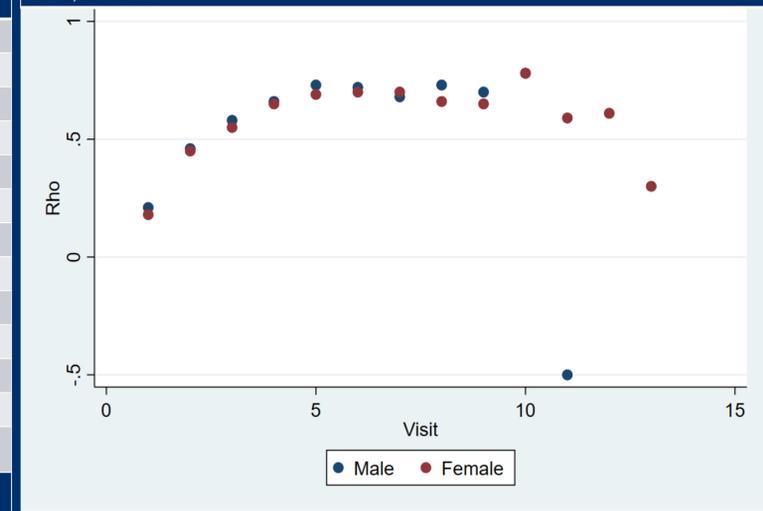


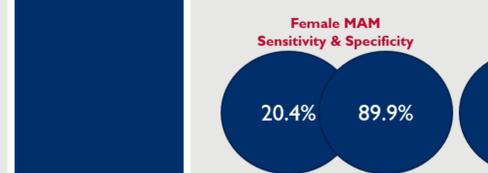
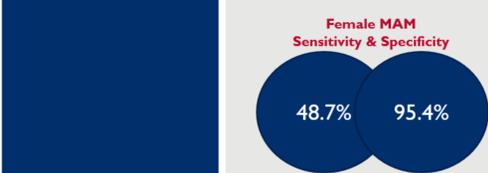
Table 2: Cohen's Kappa Coefficient (k) for MUAC and WHZ in Diagnosing SAM and MAM by sex Sierra Leone, 2016-2018

	WHZ MAM	WHZ SAM	TOTAL
All Children		k = 0.23	
MUAC MAM	2741	372	3113
MUAC SAM	407	212	619
TOTAL	3148	584	3732
Male		k = 0.24	
MUAC MAM	1498	298	1796
MUAC SAM	144	123	267
TOTAL	1642	421	2063
Female		k = 0.24	
MUAC MAM	1243	74	1317
MUAC SAM	263	89	352
TOTAL	1506	163	1669

Note: SAM: Severe Acute Malnutrition; MUAC: mid-upper arm circumference; WHZ: weight-for-height z-score; MAM = moderate acute malnutrition.

- The correlation between MUAC and WHZ at each visit ranged from 0.79 to 0.86 showing low variability and high correlation.
- The kappa statistics between MUAC and WHZ were overall poor (k = 0.20, p < 0.001), but slightly better for female (k = 0.29, p < 0.001) than for male (k = 0.16, p < 0.001) children.
- For male children, the sensitivity of the MAM diagnosis was on average 55.7% and for SAM, it was 75.9%. Specificity of the MAM diagnosis was on average 90.1% and for SAM, it was 93% across the 22 visits.
- For female children, the sensitivity of the MAM diagnosis was on average 48.7% and for SAM, it was 54.4%. Specificity of the MAM diagnosis was on average 95.4% and for SAM, it was 99.2% across the 22 visits.

- The correlation between MUAC and WHZ at each visit showed great variability and rather low correlation ranging from 0.45 to 0.78.
- The kappa statistic between MUAC and WHZ was overall fair (k=0.23, p<0.001) for both male and female children (k=0.24, p<0.001).
- For male children, the sensitivity of the MAM diagnosis was on average 40.1% and for SAM, it was 42.8%. Specificity of the MAM diagnosis was on average 64.3% and for SAM, it was 96.4% across the 10 visits.
- For female children, the sensitivity of the MAM diagnosis was on average 20.4% and for SAM, it was 26.3%. Specificity of the MAM diagnosis was on average 89.9% and for SAM, it was 99.2% across the 10 visits.



## Conclusion

- Sex-specific difference in correlation showed a slightly higher correlation between MUAC and WHZ in male children than female children.
- The Kappa value was lower for male children than female children in Burkina Faso, but in Sierra Leone sex difference in Kappa value was not present.
- In both Burkina Faso and Sierra Leone, we observe that sensitivity is consistently lower for female than for male children for both MAM and SAM.
- Altogether, the findings highlight non-negligible differences in MUAC and WHZ in identifying MAM and SAM children. Thus, our findings encourage the use of both MUAC and WHZ to thoroughly identify all acutely malnourished children.

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