SCIENTIFIC LETTER

Use of Mid Upper-Arm Circumference (MUAC) as screening tool in an urban township in the Eastern Cape: rationale for testing changed cut-off values to identify malnutrition

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Sir

Severe acute malnutrition (SAM) is still a public health concern in South Africa illustrated by the increase in the number of SAM cases from 21 598 in 2012/2013 to 23 743 in 2013/2014.[1] To decrease SAM, early identification of children with moderate acute malnutrition (MAM) is needed.

Children with a weight-for-height z-score (WHZ) < -3 standard deviations (SD) of the World Health Organisation (WHO) standard for children less than 60 months of age have a higher mortality compared to children with a WHZ > -3 SD of this standard. The WHO therefore recommends the use of a WHZ of below -3 SD to identify children with SAM.[2,3] The mid-upper arm circumference (MUAC) cut-off values of 11.5 cm and 12.5 cm are used globally as screening tools to identify SAM and MAM, respectively, in children between six and 60 months of age.[2,3] According to the WHO and UNICEF,[3] the WHZ and MUAC may be used interchangeably as a screening tool to identify malnourished infants and children, as they reveal a very similar prevalence of SAM in the field. However, more recent data indicate that there may be little overlap between the children identified with SAM and MAM by WHZ and those identified using the MUAC cut-offs.[4] Therefore, more recently the recommendation is to use WHZ and MUAC measurements as independent but complementary admission criteria for SAM.[5]

In practice in South Africa, community health workers (CHW) are trained to use MUAC as a screening tool, as limited scales and measuring equipment may be available in some areas to accurately measure and plot on the WHZ growth chart. Currently the WHO 11.5 cm and 12.5 cm cut-off values are still used by all CHW to refer SAM and MAM cases respectively, to primary health care facilities. In the context of the above concerns, the researchers assessed the value of these and newly calculated MUAC cut-off values as predictors of malnutrition risk in an urban township in the Eastern Cape.

In this descriptive study with a cross-sectional design, data from a convenience sample of 400 infants and young children younger than 24 months were gathered from five clinics and 15 early childhood development (ECD) centres in Motherwell, Nelson Mandela Bay Health District (NMBHD) from October 2015 to February 2016. The weight, length and MUAC of children were measured by trained fieldworkers according to protocols described by the CDC (2008). Since the population of children younger than two years in Motherwell was estimated at 5 817 in 2016 (personal communication, Nutrition Manager NMB, June 2016), an estimated 6.9% of the population participated in the survey. Ethical approval (H15-HEA-002) was obtained from the Research Ethics Committee (Human), NMU and the Eastern Cape

Department of Health. The Pearson correlation co-efficient (r) was used to measure the strength or degree of the relationship between variables. Sensitivity and specificity tests were used on the data with the existing recommended MUAC cut-off values as well as new calculated MUAC cut-off values to determine whether the new MUAC cut-off values were more sensitive in the identification of children affected by wasting, without including false negatives (children without SAM or MAM).

All participants ($n = 400$) were of African ethnicity. The sample consisted of 50% ($n = 199$) male participants. Of the total sample, the mean weight-for-age z-score (WAZ) was + 0.44 (SD = 1.26), the height-for-age z-score (HAZ) was -0.24 (SD = 1.34) and the mean WHZ was 0.83 (SD = 1.28). One child in the sample ($n = 1$) was classified as severely wasted, according to WHZ (WHZ < -3), with one percent ($n = 3$) moderately wasted (WHZ < -2) and six percent mildly wasted (WHZ < -1).

The current WHO MUAC cut-off values to identify MAM have a high specificity, but performed poorly when tested for sensitivity, as shown in Table 1.

The r-value (0.78) for the relationship between WHZ and MUAC suggests a dependent relationship between these two indicators. The least squares regression formula (Y = 15.409 + 0.803x (males); Y = 15.13 + 0.83x (females)) was then used to predict where WHZ = -2 is most likely to correspond with a MUAC value in cm. The new predicted MUAC values of 13.8 cm (males) and 13.5 cm (females) were subsequently tested for sensitivity and specificity. The sample was too small to calculate sensitivity for both genders, but 96.4% specificity was achieved for females (Table 1). A sensitivity of 100% and specificity of 94.5% was achieved with the male MUAC cut-off. Thus, the proposed cut-offs identified all of the wasted children (WHZ < -2), while identifying an acceptably low number of false positives.

The poor sensitivity of the current MUAC cut-off values (12.5 cm) for identifying children with MAM (WHZ < -2), suggest that the WHO cut-off values may be too low to effectively identify malnourished children in the community to do timeous referrals and prevent SAM. This problem is crucial in areas where growth monitoring activities rely heavily on MUAC due to its simplicity and low cost, as children screened for malnutrition who could potentially benefit from intervention, are missed.[6]

The low number of moderately wasted children in this sample made it problematic to determine sensitivity and specificity of MUAC in children. Measuring infants and young children in clinics and ECD centres inherently excludes children who do not attend these facilities and thus the results cannot be generalised.

Table 1. Diagnostic test results for moderate wasting (WHZ < -2) using MUAC.

	12.0 cm	12.5 cm	13.0 cm	13.5 cm	13.8 cm
Sensitivity	0.0%	0.0%	0.0%	Unde-fined* (females)	100% (males)
Specificity	100.0%	99.6%	99.6%	96.4%	94.5%

*Sample size limitation.

The current WHO MUAC cut-off values lacked the sensitivity to identify cases of MAM in a South African urban township population. A revised, single MUAC cut-off value for males and females younger than two years may increase the correct diagnosis of MAM, thus providing health workers the opportunity to prevent SAM. This new cut-off value should be tested in the field with larger samples.

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