Relationship between mid-upper arm circumference and weight changes in children aged six to 59 months

Research summary

Location: Malawi, Ethiopia and Bangladesh

What we know: MUAC is recognised as an independent admission/discharge criterion for SAM treatment; the relationship between weight and MUAC change needs further investigation.

What this article adds: A recent study explored the relationship between weight and MUAC changes in children under SAM treatment and the sensitivity of both indicators to disease episodes in Malawi (research conditions), Ethiopia and Bangladesh (both field conditions). Results show that MUAC and weight gain achieved over the entire treatment episode were strongly correlated in all three country contexts, irrespective of treatment outcome. Both appeared to respond rapidly (within one week or less) and similarly to episodes of illness reported during outpatient treatment. The results suggest that monitoring MUAC during treatment for SAM could provide a useful alternative to monitoring weight, particularly where weight measurement is not feasible.

Mid-upper arm circumference (MUAC) is routinely used in the outpatient treatment of severe acute malnutrition (SAM) as an independent admission and discharge criteria, as recommended by the World Health Organisation (WHO) (WHO, 2006). However, treatment protocols recommend weight gain as the primary method of monitoring the recovery of children during treatment for SAM. It has been suggested that MUAC is not suitable for monitoring recovery from SAM as increases in MUAC are thought to lag behind increases in weight. In December 2012, a consultation between United Nations, academic and non-governmental organisation (NGO) staff responsible for the design and management of therapeutic feeding programmes, organised by ENN, identified a lack of evidence regarding the relationship between weight gain and MUAC changes (ENN, 2013). This paper examines the relationship between weight gain and MUAC changes in children aged six to 59 months who were treated for SAM as outpatients in community-based management of acute malnutrition (CMAM) in order to add to the evidence base.

The objectives of this study were to describe:

1. The relationship between weight changes and MUAC changes in children aged between six and 59 months during treatment for SAM in CMAM programmes; and
2. The sensitivity of both MUAC and weight to episodes of disease experienced during the SAM treatment episodes in CMAM programmes.

The study was carried out in three country contexts: Malawi, Ethiopia and Bangladesh. In Malawi, data were collected on children aged six to 59 months with a MUAC ≤ 115 mm enrolled in outpatient treatment for SAM, following Malawi National CMAM Guidelines, at Ministry of Health facilities. MUAC and weight were measured on admission and at each subsequent weekly visit until they reached the discharge criteria of having a MUAC greater than 125 mm at two consecutive visits. Information on illness was recorded each week, based on seven-day recall from the carer attending with the child. These data were collected under research conditions by a single observer to minimise measurement errors. Prospective data were also obtained from CMAM programmes implemented by NGOs in two other country contexts: Ethiopia (Save the Children USA (SC-US)) and Bangladesh (Terre des hommes (Tdh)). Measurement and collection of the SC-US Ethiopia data were
supervised by SC-US supervisors who were present at all clinic sessions. The SC-US Ethiopia data were entered from beneficiary record cards. Measurement and collection of the Tdh Bangladesh data were supervised by Tdh monitoring and evaluation staff, who visited clinics on a rotating basis with each clinic being visited on, at least, a quarterly basis. Clinic activities were monitored using a checklist of observations of key activities.

Data collected in Malawi were analysed for the correlation between MUAC and weight changes using the Pearson product-moment correlation coefficient (Pearson’s r). Data from Ethiopia and Bangladesh were similarly analysed. The association of growth failure following recent episodes of illness were assessed for MUAC and weight change using a two-by-two table, box-plots and Kruskal-Wallis non-parametric rank sum test.

Results show that MUAC and weight gain achieved over the entire treatment episode were strongly correlated in all three country contexts; Ethiopia (r = 0.816, 95% CI [confidence interval] = 0.782 - 0.845), Malawi (r = 0.843, 95% CI = 0.802 - 0.876) and Bangladesh (r = 0.725, 95% CI = 0.663 - 0.777). MUAC and weight changes at each outpatient visit were closely correlated (r = 0.954, 95% CI = 0.602 - 0.997) under research conditions. The field data from Ethiopia and Bangladesh showed similar correlation (r = 0.945, 95% CI = 0.685 - 0.998) and (r = 0.939, 95% CI = 0.705 - 0.994) respectively. MUAC and weight appear to respond rapidly and similarly to episodes of illness reported during outpatient treatment for SAM. For MUAC, the relative risk (RR) for diarrhoea was 1.88 (95% CI = 1.64 - 2.15), vomiting RR = 1.89 (95% CI = 1.58 - 2.26), fever RR = 1.57 (95% CI = 1.36 - 1.82) and cough RR = 1.42 (95% CI = 1.22 - 1.65). Similar RRs are seen for weight; diarrhoea RR = 2.03 (95% CI = 1.77 - 2.31), vomiting RR = 2.09 (95% CI = 1.77 - 2.47), fever RR = 1.76 (95% CI = 1.53 - 2.03) and cough RR = 1.25 (95% CI = 1.06 - 1.48).

The relationship between weight changes and MUAC changes in children aged six to 59 months at each follow-up visit during outpatient treatment for SAM shows a strong correlation in all contexts, irrespective of the treatment outcome. This correlation was observed whether the data were collected under research or operational field conditions. Both MUAC and weight respond negatively to episodes of illness, with comparable magnitudes of change for each illness. The response for both is similarly rapid (i.e. within a period of one week or less), with no obvious lag, irrespective of the type of illness reported. With the acceptance of MUAC as both an admission and discharge criterion, the results of this study suggest that MUAC could also be used for monitoring the recovery of the child. While the response to treatment for SAM would normally be monitored using weight, the results of this study imply that a very similar recovery trajectory would be observed if MUAC were used for monitoring instead.

The authors conclude that changes in weight and MUAC observed during treatment for SAM in outpatient therapeutic programmes are closely correlated in data from three different country contexts under research and field operational conditions. Changes in weight and MUAC resulting from episodes of diarrhoea, vomiting, fever and cough respond similarly and rapidly without any lag effect on the part of MUAC. The results suggest that monitoring of MUAC during treatment for SAM could provide a useful alternative to monitoring weight. Admission, monitoring recovery and discharge from treatment using MUAC alone provides a potential opportunity to further decentralise the treatment of SAM to areas where weighing equipment may be unavailable or access to health facilities is limited, potentially improving programme coverage and effectiveness. Further research is required in order to develop and test appropriate MUAC monitoring tools and safe corresponding care protocols for field testing in various contexts.

References


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