prevent the complications in adulthood.

*Contributors*: DK: Design, data collection, analysis and drafting the manuscript; PS: Conception, data collection, analysis and revising the manuscript; RVP: Design, data collection, analysis and revising the manuscript; ZS: Conception, design, data interpretation.
*Funding*: Pondicherry Institute of Medical Sciences;
*Competing interests*: None stated.

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# Is Mid-upper Arm Circumference Alone Sufficient to Identify Severe Acute Malnutrition Correctly?

Anthropometric data of 2466 children in Haryana revealed low sensitivity (6.9%) and positive predictive value (14.3%) of Mid-upper Arm Circumference (MUAC) at 115 mm cut-off for identifying Severe acute malnutrition (SAM). This raises concerns regarding the reliability of MUAC as a screening tool to identify SAM at the community-level.

**Keywords:** *Anthropometry, Diagnosis, Undernutrition*.

Mid-upper-arm-circumference (MUAC) is used to detect severe acute malnutrition (SAM) among under-five children in community settings due to its ease of use. WHO had earlier fixed a cut-off of 110 mm, but later suggested a new cut-off of 115 mm for defining SAM based on experience from African countries [1]. However, there is a paucity of data validating these cut-offs in Indian setting [2].

A community-based cross-sectional survey was carried out in four districts of Haryana. In each district, 10% of Sub-centres (SC) areas were selected randomly with representation from rural, urban and slum areas according to Probability Proportionate to Size. 40 children were selected from each sub-centre, divided equally from two randomly selected villages under the Sub-centre. A total of 2466 children in the age group 6 mo-6 years were included in the study. Anthropometric measurements such as weight (up to nearest 1g, using TARE function), height (up to nearest 1 mm) and recumbent length in case of infants (up to nearest 1 mm) were measured using standard equipment and procedures by graduate level field investigators who were trained in use of anthropometric equipment [3]. The Mid Upper Arm Circumference (MUAC) was measured using Shakir's tape [4]. Nutritional assessment was carried out using WHO Child Growth Standards according to z-score classification. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of MUAC method was calculated for different cut-offs against weight-for-height Z scores below –3. Ethical clearance was obtained from the Institute Ethics Committee of Post Graduate Institute of Medical Education and Research (PGIMER), Chandigarh. The children diagnosed with SAM were referred to the district hospital, with follow up by local Auxiliary nurse midwife.

The study population included 1428 (58%) males. The mean (SD) age of subjects was 29.3 (14.5) months. The mean (SD) weight, height and MUAC were 10.5 (2.64) kg, 83.1 (10.67) cm, and 14.1 (1.4) cm, respectively. As compared to the gold standard test, MUAC (<115 mm) method was found to have a high specificity (96.4%) and NPV (92.2%) but very low PPV (14.3%) and sensitivity (6.9%). Sensitivity and positive predictive values were higher when MUAC –3 Z score cut-off was used as compared to MUAC less than 11.5 cm cut-off (***Web Table* I**). Prevalence of SAM when computed using WHZ scores was found to be 3.5% (children below –3 WHZ score), but with MUAC method, it was found to be 2.3% and 1.8% for children below –3 MUAC Z-score and children with less than 11.5 cm MUAC, respectively. In this study, the prevalence of SAM based on WHZ was found to around

two times than those based on a MUAC cut-off of 115 mm. Other studies have reported that MUAC and WHZ identify different populations of children with SAM [5,6]. Previous studies have recommended higher cut-off levels (135 or more, even 155 mm) [7,8]. In this study, the MUAC cut off at 115 mm had zero sensitivity in the 3-6 year age group though higher cut off levels (<130 mm) had better sensitivity (24.2%). Part of the explanation for our findings is that children with lower MUAC tend to be younger than those with lower weight-for-height scores. The results suggest that a single cut-off cannot be used to screen nutritional status for all children below six years but should be increased with increasing age of children, as stated in another study [9]. Generalizability might be an issue which necessitates large scale community studies.

MUAC alone does not appear to be appropriate for diagnosis of SAM. Keeping in view the findings of our study, MUAC may be used along with simple clinical indicators such as bipedal edema and weight-for-height cut-off measurements.

*Contributors*: JPT: data analysis, preparation of the first draft of the manuscript and editing of the draft. AS: collection of data, analysis of data and editing of the draft. SP: conceived the idea, supervised data collection and edited the manuscript.

*Funding*: National Rural Health Mission of the Government of Haryana. *Competing interests*: None stated.

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# Effect of Fortification and Additives on Breast Milk Osmolality

This study evaluated the effect of fortification and commonly used additives on the osmolality of human milk. Osmolality after fortification with milk powder and human milk fortifier increased from 303 mOsmol/kg to 397 and 373 mOsmol/kg, respectively. The maximal increase in osmolality was seen with the addition of calcium gluconate.

**Keywords:** *Breastfeeding, Human milk fortifier, Infant feeding*.

Fortification of human milk is commonly used to achieve adequate postnatal growth of preterm infants. This can be done using either commercially available human milk fortifiers (HMF) or infant milk powder [1]. Several studies have evaluated the effect of HMF on osmolality of milk, but effect of infant milk powder and other additives has not been adequately studied. Various additives like calcium, iron and multivitamins may increase the osmolality beyond the recommended levels (<450 mOsmol/kg) [2-4]. Increased osmolality of milk has been associated with feed intolerance, delayed gut emptying and necrotizing enterocolitis [3,5,6]. We evaluated the effect of different combinations of fortification and commonly used additives on the osmolality of preterm human milk.

The osmolality was measured with freezing point depression method, using an osmometer (Osmomat 030 Germany). A thermistor probe measured the difference in freezing point of the solution measured from the reference. The instrument was regularly calibrated and was checked with internal controls for each batch of analysis of milk samples. Freshly expressed breast milk (EBM) was