Anthropometric indicators to identify a pregnant woman as acutely malnourished and predict adverse birth outcomes

Summary of published research

Location: Global

What we know: There is no consensus on how to identify pregnant women as acutely malnourished and when to enrol them in nutritional programmes. MUAC is suggested in Sphere as a criterion, with cut-offs ranging from 21cm-23cm in different contexts.

What this article adds: A MSF literature review explored values of anthropometric indicators for acute malnutrition in pregnant women that are associated with adverse birth outcomes in humanitarian contexts. It concludes that MUAC is a reliable indicator of risk of low birth weight (LBW) and <23 cm cut-off should be used to enrol pregnant women in nutritional programmes. There was insufficient review evidence to categorise moderate and severe acute malnutrition cut-offs. Short maternal stature (146-157 cm)can be used to identify risk for LBW and obstetric complications. Further research is needed regarding risk cut-offs for BMI, maternal weight for gestation age, and maternal height and to determine to what extent nutritional programmes can avert LBW risk.

Currently there is no consensus on how to identify pregnant women (PW) as acutely malnourished and when to enrol them in nutritional programmes. According to the SPHERE Guidelines, mid upper arm circumference (MUAC) may be used as a screening tool for PW, e.g. as a criterion for entry into a feeding programme. The guidelines state that cut-off points for risk vary by country and range from 21 cm to 23 cm.

SPHERE suggests <21 cm as an appropriate cutoff for selection of PW at risk for growth retardation during emergencies. Some nutritional protocols enrol PW based on gestational age (mostly only in the third trimester) regardless of any anthropometric measurement. Different sections of Médecins Sans Frontières (MSF) are currently using MUAC <18.5 or <21.0 cm to include PW in Supplementary Feeding Programmes (SFPs). The United Nations High Commissioner for Refugees (UNHCR) recommends <23 cm but states also to use <21 cm, depending on the proportions of women falling under each category of MUAC and available resources.

Review

MSF Switzerland recently undertook a literature review with the purpose of determining values of anthropometric indicators for acute malnutrition that are associated with adverse birth outcomes. The study examined currently used indicators, such as MUAC and Body Mass Index (BMI), but also looked at other potentially important indicators, such as maternal weight for gestational age, maternal weight gain, and maternal height. The adverse birth outcomes that were studied were low birth weight (LBW), intra-uterine growth retardation (IUGR) and pre-term birth (PTB) as they are strongly related to infant survival.

Though maternal mortality was regarded as an important outcome to investigate, there were insufficient studies that examined maternal anthropometry and the relation to maternal mortality. Thus, it was not included in this study.

Methods
A literature search in PUBMED was done covering 1 January 1995 to 12 September 2012 with the key terms maternal anthropometry and pregnancy (only human studies in English were selected with an abstract and/or full text). The search provided 6,697 records which were subsequently narrowed down to 4,000 records when publications were filtered excluding studies with specific drugs or hormones, diseases, environmental exposure, substance abuse, triplets, twins, in-vitro fertilisation, obesity, cigarette smoking, and anaemia. The search was further limited to studies that reported on one or more of the selected anthropometric indicators (MUAC, BMI, maternal weight and/or weight gain and/or height), that provided statistical tests such as odds ratio (OR) or relative risk (RR) and on LBW, PTB or IUGR. The search provided 310 records. Additionally, four more relevant studies were found when reference lists of selected studies were examined.

Most studies indicate a MUAC ranging from <22.0 cm to <27.6 cm with statistical significance for LBW. Cut-off values of <22 and <23 cm were strongly indicative for identifying a PW as high risk for LBW. Cut-off values were not strongly linked to gestational age. As there are insufficient data available on IUGR and PTB, these outcomes were not further analysed.

Most studies indicate a BMI ranging from <18.5 to <20.5 with statistical significance for LBW. BMI changes during pregnancy, and there is insufficient evidence from this to indicate one cut-off value for a specific gestational age for BMI in developing countries. As there are insufficient data available on IUGR and PTB, these were not further analysed.

Most studies indicate a maternal weight for gestational age ranging from <43.5 kg to <50 kg with statistical significance for LBW. There is no clear cut-off value for maternal weight per gestational age, but <45 kg seems indicative for high risk of LBW in Asian countries regardless of gestational age. Insufficient data available on IUGR and PTB meant that these were not further analysed. There were insufficient data available demonstrating OR or RR on overall weight gain and cut-off values in developing countries for PW in relation to LBW, IUGR and PTB.

Most studies indicate a maternal height ranging from <146 cm to <156 cm with statistical significance for LBW. There is no clear one cut-off value for maternal height. Again, insufficient data available on IUGR and PTB determined that these were not further analysed.

The review had several limitations including only examining articles published in English, inclusion of some studies that included pregnant adolescents who may have differences in physiology and anthropometry compared with their adult peers and variations between studies in sample size, methodology and context. Comparisons therefore needed to be made with care. Another critical limitation was that there have been few studies since 1995 linking maternal anthropometry during pregnancy and maternal survival.

The authors of the review assert that the best anthropometric indicator to use in a humanitarian context would be a measurement that is simple, easy to conduct, and ideally unrelated to gestational age, as the latter is generally not exactly known in the contexts where humanitarian emergencies take place. An added value would be that the indicator can be ‘universally’ used, especially for African or Asian contexts where many humanitarian emergencies occur.

**Key findings**

Key findings from the review include:

1. More studies need to be undertaken to research specific cut-off points for BMI to be measured, for example, in the first, second or third trimester, and that can identify risk for PW on LBW.
2. In the humanitarian context where gestational age is often not exactly known, it is not possible to recommend a cut-off value on maternal weight per gestational age for universal use. It would be
worthwhile to further investigate if <45 kg at any time of pregnancy could be used in future emergencies in the Asian context.

As there is no clear evidence of which weight gain cut-off is most sensitive to LBW, and as weight gain changes per trimester and a minimal of two measurements are needed, this indicator is not useful for screening purposes in emergencies.

Maternal height as a potential indicator for LBW lacks a clear cut-off value for general use in developing countries to identify LBW risk. However, short maternal stature is strongly associated with an increased risk of obstructed labour due to cephalo-pelvic disproportion and infant underweight. Thus, short maternal stature (146-157 cm) can be used as such to identify risk for LBW; furthermore it can be used to identify women with obstetric risks.

MUAC is a good indicator of the protein reserves of a body, and a thinner arm reflects wasted lean mass, i.e. malnutrition. However, the data indicate that a cut-off value of 21 cm might be too low. As LBW has detrimental effects on a child’s survival, it seems that a more inclusive approach with a MUAC cut-off of <22 or <23 cm should be used to indicate risk of LBW and to use as entry criterion for nutritional programmes. MUAC is rather insensitive to changes over the total period of pregnancy for adult women, is easy to measure, and requires only one measurement. More research is needed whether different cut-off values should be used for the Asian or African continent, but current data suggest that <23 cm appears adequate for both continents. It is also the most conservative cut-off value ensuring the most PW at risk for LBW are included. It is likely that the relevance of the use of MUAC is similar in different humanitarian emergencies, be it conflict, natural disaster, sudden or slow onset.

Currently, there is no data available that differentiates PW from being moderately or severely malnourished, i.e. having categories for MUAC that indicate high or relatively even higher risks for adverse outcomes. This does not mean they do not exist, but that this literature review does not provide sufficient evidence to support the creation of such categories.

Further research is needed to evaluate whether the combined use of one or two easily measurable anthropometric indicators can have a high predictive power for risk of adverse birth outcomes in humanitarian contexts. In addition, research is needed to determine to what extent enrolment in nutritional programmes of PW with a MUAC <23 cm can avert risk of LBW.

The authors conclude that in the humanitarian context, MUAC can be used as a reliable indicator of risk of LBW. A cut-off value of <23 cm should be used to enrol PW in nutritional programmes. National protocols from Ministries of Health and humanitarian organisations that currently use a MUAC <21 cm to enrol PW in SFPs should consider increasing the cut-off value in order to reduce the risk of LBW infants.

1Mija-tesse. V et al (2013). Which Anthropometric Indicators Identify a Pregnant Woman as Acutely Malnourished and Predict Adverse Birth Outcomes in the Humanitarian Context? PLoS Curr. 2013 June 7; 5: ecurrents.dis.54a8b618c1bc031ea140e3f2934599c8. doi: 10.1371/currents.dis.54a8b618c1bc031ea140e3f2934599c8

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