

Concerns that *The Lancet* double-burden series may undermine moderate wasting treatment

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In *The Lancet* series on the double burden of malnutrition (summarised in this issue), the paper by Hawkes highlights the burden of the modern epidemic of obesity and recommends double-duty actions aimed to combat malnutrition in all its forms (Hawkes *et al*, 2020). The authors understand that this is an imperative global priority for achieving the Sustainable Development Goals (SDGs). However, the paper simplistically raises a villain in “high fat, nutrient-dense foods”, urging considerable caution in their use. In particular, this piece raises concern that the supplementary feeding of children with moderate acute malnutrition (MAM) increases the risk of overweight/obesity in adulthood, which is not substantiated by evidence and therefore misleading.

Hawkes raise four concerns about potential long-term consequences of food supplements designed to treat and prevent acute malnutrition, but fail to present the immediate and sometimes fatal consequences of MAM. Children with MAM are at three times greater risk of death (Chang *et al*, 2013) and MAM accounts for 6% of the disability-adjusted life years (DALYs) lost. Children with MAM are at increased risk of infectious disease, slower recovery from illness, and delayed cognitive and physical development. If left untreated, the one-year risk of death for MAM is 3.6% and progression to severe acute malnutrition (SAM) is 8.1% (Isanaka *et al*, 2019). These are unacceptably high risks, given that the possibility of developing obesity later in life has never been demonstrated.

The first concern raised about supplementary feeding for MAM is that rapid weight gain during early childhood might lead to metabolic syndrome later in life. The assumption is that the rapid weight gain seen in MAM recovery is primarily fat. However, data show the weight gained in supplementary feeding is predominantly lean mass (Fabiansen *et al*, 2017) and recovery from childhood malnutrition does not lead to increased non-communicable diseases (NCD) later in life (Adair *et al*, 2013). A study in Burkina Faso found that 93.5% of the weight gained during supplementary feeding was lean tissue when children under two years old with MAM were fed a lipid nutrient supplement (LNS) or corn-soy blend (CSB), and LNS produced more fat-free mass (FFM) when compared to CSB (Fabiansen *et al*, 2017). Similarly, a longitudinal study in Malawian children who received inpatient SAM treatment found no differences in metabolic outcomes of those children when compared with siblings and age-matched controls. They had similar lean body mass when com-

pared to their siblings and there was no difference in cholesterol, glucose tolerance test, cortisol level, Hgb A1c between cases and controls (Lelijveld *et al*, 2016).

Data from a birth cohort study in five low-or middle-income countries (LMICs) not specifically treating children for MAM but often referenced in the argument against supplementary feeding found that birth weight and rate of weight gain in the first two years of life were associated with increased FFM in adulthood (Kuzawa *et al*, 2012). Most studies focus on the correlation between the effect of childhood weight gain on adult body mass index (BMI), which does not separate lean body mass from fat mass, but this study found that infant weight gain did correlate with a higher adult BMI, primarily via the effect on lean body mass. Data from the same cohort was used in another analysis that found that higher weight gain by age two was associated with a decreased risk of short stature and not completing secondary school and no correlation with hyperglycemia (Adair *et al*, 2013). Taken together, these studies found that more weight gain by age two correlated with more education, less risk of short stature, more lean body mass and no effect on glycemic control.

The second concern Hawkes raise is that the intake of supplements could alter the gut microbiome of the recipient and influence taste preferences, leading to higher sugary food consumption later in life. The references cited to support this concern include a commentary on perceived life-course implications of ready-to-use therapeutic food (RUTF) and a study from children in European countries. While there are studies that show that supplementary food does affect the microbiome, these findings show that it returns the microbiome to a healthier, less dysbiotic state than the microbiota profile seen in malnutrition (Smith *et al*, 2013). Another study looked directly at the effects of supplementary feeding on the faecal microbiome in infants age six to eight months fed LNS and found that microbiome diversity at 18 months was higher in the LNS group compared to control children who did not receive supplementation (Kamng'ona *et al*, 2020). The concern that supplementary food products would alter the taste preferences of children, thereby increasing sugary food consumption later in life, is supported by a study in five European countries that used food diaries of children at seven time points between one and eight years old and found a correlation between unhealthy diets at one and two years with unhealthy

diets at eight years (Luque *et al*, 2018). In addition to the limited generalisability of this study to children in LMICs, especially in rural settings (given that these children are from high-income countries with a greater variety and availability of processed food), it is also plausible that the results reflect the food preferences and nutritional knowledge of the caregivers who are purchasing the foods, rather than a true test of taste preferences. In contrast, a 2019 study in Ghana looked at a cohort of children who received LNS at six months and found that, at four to six years old, there was no difference in the consumption of or preference for sweet foods between children who received LNS and the controls (Okronipa *et al*, 2019).

The third concern raised by Hawkes is that supplements may be mistargeted or diverted from beneficiary child, resulting in inappropriate intake and weight gain in others, citing a study of maternal gestational weight gain and risk of childhood obesity among women in North Carolina, USA (Sridhar *et al*, 2014). If the concern is excessive maternal intake of supplements targeted to the child, this is undue. Many women in LMICs have inadequate weight gain during pregnancy based on Institute of Medicine standards, despite receiving additional protein-energy supplementation; therefore, if they were to consume these supplements, the result is unlikely to be excessive gestational weight gain (Callaghan-Gillespie *et al*, 2017; Hambidge *et al*, 2009). The concern around the mistargeting of supplements due to errors in detection and sharing at a household level is erroneous as, if it were to occur, it is unlikely to lead to detrimental effects among children receiving the supplementary food. It is widely known that undernutrition and wasting

disproportionately affect the poor, uneducated and rural populations of LMICs. Sharing of foods among household members can be difficult to evaluate, as bias can be introduced through many of the evaluation methods; however, sharing of supplementary foods, especially ready-to-use supplementary foods (RUSF), may be less common than the authors of the series think (Flax *et al*, 2010 and Wang *et al*, 2013). Overweight becomes a major problem as national income increases; however, the poorest individuals in poor countries remain at heightened risk of underweight (Reyes *et al*, 2019). Errors in the detection and diagnosis of acute malnutrition may occur, although these are not common occurrences and should not contribute to the development of overweight individuals. Identification of acute malnutrition in communities can be successfully achieved through standard protocols. Mid-upper arm circumference (MUAC) tapes are widely used in programmes to identify children with acute malnutrition and have been shown to be accurately used to identify wasted children by both community health workers and mothers (Blackwell *et al*, 2015 and Ale *et al*, 2016).

The final concern raised by Hawke is that supplementary feeding programmes may result in the displacement of counselling and optimal feeding practices. Nutrition counselling and supplementary feeding go hand-in-hand. Although counselling interventions may be successful if adherence is good, real-world conditions must be considered and motivation for attendance of counselling-only sessions may be diminished. Evidence suggests, however, that the provision of supplements may improve adherence to counselling programmes (Nikiema *et al*, 2014). Al-

though further data is needed to fully elucidate the risks of a counselling-only programme for MAM and studies are ongoing (Lelijveld *et al*, 2019), a Burkina Faso study demonstrated significantly lower recovery rates among children receiving counselling alone compared to treatment with fortified blended flour or RUSF (57.8% vs 74.5% or 74.2%, respectively) (Nikiema *et al*, 2014) and a recent meta-analysis demonstrated higher recovery rates in children receiving nutritional supplementation when compared to counselling (Lelijveld *et al*, 2020).

Finally, in contrast with the concern of Hawkes about the provision of supplementary foods and sub-optimal complementary feeding practices, studies have demonstrated that the provision of LNS increased or preserved breastfeeding frequency with no decrease in dietary diversification (Arimond *et al*, 2017 and Cambell *et al*, 2016).

In conclusion, the concerns raised by Hawke and the potential risks associated with MAM treatment presented in this section of their paper are not well evidenced. Given that the long-term risks of supplementary feeding of MAM cases are evidently low, the mortality and long-term morbidity for children with untreated MAM are critical and must not be ignored. All children suffering from wasting, be it due to food insecurity or excessive inflammation, deserve to be given one of life's simple necessities – enough to eat.

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For more on this topic see Research Snapshot on page 53 and at <https://www.enonline.net/fex/62/thelancetriesonthedoubleburdenofmalnutrition>

References

- Adair LS, Fall CH, Osmond C. Associations of linear growth and relative weight gain during early life with adult health and human capital in countries of low and middle income: findings from five birth cohort studies. *Lancet* 2013; **382**(9891): 525-34.
- Ale FG, Phelan KP, Issa H. Mothers screening for malnutrition by mid-upper arm circumference is non-inferior to community health workers: results from a large-scale pragmatic trial in rural Niger. *Arch Public Health* 2016; **74**(1): 38.
- Arimond M, Abbeddou S, Kumwenda C. Impact of small quantity lipid-based nutrient supplements on infant and young child feeding practices at 18 months of age: results from four randomized controlled trials in Africa. *Matern Child Nutr* 2017; **13**(3).
- Blackwell N, Myatt M, Allafort-Duverger T, Balogoun A, Ibrahim A, Briand A. Mothers Understand And Can do it (MUAC): a comparison of mothers and community health workers determining mid-upper arm circumference in 103 children aged from 6 months to 5 years. *Arch Public Health* 2015; **73**(1): 26.
- Callaghan-Gillespie M, Schaffner AA, Garcia P. Trial of ready-to-use supplemental food and corn-soy blend in pregnant Malawian women with moderate malnutrition: a randomized controlled clinical trial. *Am J Clin Nutr* 2017; **106**(4): 1062-9.
- Campbell RK, Hurley KM, Shamim AA. Effect of complementary food supplementation on breastfeeding and home diet in rural Bangladeshi children. *Am J Clin Nutr* 2016; **104**(5): 1450-8.
- Chang CY, Trehan I, Wang RJ. Children successfully treated for moderate acute malnutrition remain at risk for malnutrition and death in the subsequent year after recovery. *J Nutr* 2013; **143**(2): 215-20.
- Fabiensan C, Yameogo CW, Luel-Brockdorf AS. Effectiveness of food supplements in increasing fat-free tissue accretion in children with moderate acute malnutrition: A randomised 2 x 2 x 3 factorial trial in Burkina Faso. *PLoS Med* 2017; **14**(9): e1002387.
- Flax VL, Phuka J, Cheung YB, Ashorn U, Maleta K, Ashorn P. Feeding patterns and behaviors during home supplementation of underweight Malawian children with lipid-based nutrient supplements or corn-soy blend. *Appetite* 2010; **54**(3): 504-11.
- Hambidge KM, Westcott JE, Garces A. A multicountry randomized controlled trial of comprehensive maternal nutrition supplementation initiated before conception: the Women First trial. *Am J Clin Nutr* 2019; **109**(2): 457-69.
- Hawkes C, Ruel MT, Salm L, Sinclair B, Branca F. Double-duty actions: seizing programme and policy opportunities to address malnutrition in all its forms. *Lancet* 2020; **395**(10218): 142-55.
- Isanaka S, Barnhart DA, McDonald CM. Cost-effectiveness of community-based screening and treatment of moderate acute malnutrition in Mali. *BMJ Glob Health* 2019; **4**(2): e001227.
- Kamng'ona AW, Young R, Arnold CD. Provision of Lipid-Based Nutrient Supplements to Mothers During Pregnancy and 6 Months Postpartum and to Their Infants from 6 to 18 Months Promotes Infant Gut Microbiota Diversity at 18 Months of Age but Not Microbiota Maturation in a Rural Malawian Setting: Secondary Outcomes of a Randomized Trial. *J Nutr* 2020.
- Kuzawa CW, Hallal PC, Adair L. Birth weight, postnatal weight gain, and adult body composition in five low and middle income countries. *Am J Hum Biol* 2012; **24**(1): 5-13.
- Lelijveld N, Seal A, Wells JC. Chronic disease outcomes after severe acute malnutrition in Malawian children (ChroSAM): a cohort study. *Lancet Glob Health* 2016; **4**(9): e654-62.
- Lelijveld N, Hendrixson DT, Godbout C. Defining and treating "high-risk" moderate acute malnutrition using expanded admission criteria (Hi-MAM Study): A cluster-randomised controlled trial protocol. *Field Exchange*. 2019 July 2019.
- Lelijveld N, Beedle A, Farhikhtah A, Elyayah EE, Bourdairre J, Aburto N. Systematic review of the treatment of moderate acute malnutrition using food products. *Matern Child Nutr* 2020; **16**(1): e12898.
- Nikiema L, Huybregts L, Kolsteren P. Treating moderate acute malnutrition in first-line health services: an effectiveness cluster-randomized trial in Burkina Faso. *Am J Clin Nutr* 2014; **100**(1): 241-9.
- Okronipa H, Arimond M, Arnold CD. Exposure to a slightly sweet lipid-based nutrient supplement during early life does not increase the level of sweet taste most preferred among 4- to 6-year-old Ghanaian children: follow-up of a randomized controlled trial. *Am J Clin Nutr* 2019; **109**(4): 1224-32.
- Reyes Matos U, Mesenburg MA, Victora CG. Socioeconomic inequalities in the prevalence of underweight, overweight, and obesity among women aged 20-49 in low- and middle-income countries. *Int J Obes (Lond)* 2019.
- Smith MI, Yatsunenko T, Manary MJ. Gut microbiomes of Malawian twin pairs discordant for kwashiorkor. *Science* 2013; **339**(6119): 548-54.
- Sridhar SB, Darbinian J, Ehrlich SF. Maternal gestational weight gain and offspring risk for childhood overweight or obesity. *Am J Obstet Gynecol* 2014; **211**(3): 259 e1-8.
- Wang RJ, Trehan I, LaGrone LN. Investigation of food acceptability and feeding practices for lipid nutrient supplements and blended flours used to treat moderate malnutrition. *J Nutr Educ Behav* 2013; **45**(3): 258-63.