

The relationship between wasting and stunting in young children: A systematic review

This is a summary of the following paper:

Thurstans S, Sessions N, Dolan C, Sadler K, Cichon B, Isanaka S et al (2022) *The relationship between wasting and stunting in young children: A systematic review. Maternal & Child Nutrition*, 18, e13246. Available at:

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A mother and her baby participate in a nutrition activity in their community in Bertoua, in the east of Cameroon

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Key messages:

- A large number of children experience concurrent wasting and stunting – a condition that carries a high mortality risk – and this can vary by context, although fragile and conflict-affected states appear to be disproportionately affected.
- Wasting has been found to lead to stunting and, to a lesser extent, stunting to lead to wasting, although the physiological mechanisms are less clear for this direction of the relationship.
- Research is needed to determine if the treatment of wasting could be adapted to better lay the foundation for linear growth.

Background

In 2014, the Wasting and Stunting Technical Interest Group (WaSt TIG) published a technical briefing paper on the relationship between wasting and stunting. Building on this, a systematic review was conducted to explore evidence generated since 2014 to understand the current evidence on the relationship between wasting and stunting and the implications of the relationship on interventions to improve child health, nutrition and survival.

Methods

Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines were followed and search terms were identified to describe wasting and stunting and the relationship between the two conditions and run through Medline, Embase and global health databases. Studies addressing wasting and stunting separately or studies that did not report on either condition in relation to the other were excluded. Three main themes were identified including a physiological understanding of the similarities in wasting and stunting, the interrelationship between the two conditions and the implications of this relationship. A total of 45 studies and reports were included.

Findings

Interconnected physiological processes in wasting and stunting

Wasting and stunting both occur when nutrient intakes are insufficient to meet the requirements for growth and/or to support the immune response to infection. When this happens, the body

draws on nutritional reserves, mainly fat and muscle. The loss of fat and muscle, the interaction with infection and the ensuing reduced production of hormones such as leptin have all been identified as important physiological processes linking wasting and stunting but further research is warranted. In particular, further work is needed to better understand the role of gut health/inflammation, body composition and its relationship with anthropometric indicators and functional outcomes, the contribution of lean and fat tissue during and after recovery from wasting and the role of environmental factors.

The timing of wasting and stunting

The targeting of nutrition interventions often focuses on children from 6-59 months of age. However, evidence shows that wasting and stunting incidence peaks between birth and three months, with implications for further deterioration in infancy and childhood. With a significant degree of child undernutrition also established before birth, greater coordination between interventions targeting adolescent girls and mothers and those aiming to prevent child undernutrition is needed.

Evidence for the relationship between wasting and stunting

Analysis of both population-level cross-sectional datasets and longitudinal data is supportive of a link between wasting and stunting that is more than just chance. Likewise, within treatment programmes for severe acute malnutrition (SAM), evidence of a relationship is also apparent in that children with SAM are often also stunted.

Research has also shed light on the processes involved in this relationship. Wasting has been found to lead to stunting and, to a lesser extent, stunting to lead to wasting, although the physiological mechanisms are less clear for this direction of the relationship. In the case of wasting leading to stunting, evidence suggests that the body's response to weight faltering is to slow or halt linear growth until weight is gained and any infection is treated. These findings highlight the importance of integrated medical and nutritional care of children receiving wasting treatment to ensure the effects of wasting on linear growth are minimised. Seasonal patterns also contribute. Research from the Gambia (Schoenbuchner et al, 2019) showed that wasting in a child's first wet season (hungry season) increased the odds of wasting in their second wet season by a factor of 3.2, even if they had recovered in the intervening harvest period. Likewise, infants born at the start of the wet season did not catch up in weight to the same extent as their peers born in other months and experienced both more wasting during childhood and an increased risk of becoming stunted by two years of age.

Concurrent wasting and stunting

A large number of children experience concurrent wasting and stunting and this can vary by context. Fragile and conflict-affected states appear to be disproportionately affected with higher rates of concurrent wasting and stunting than stable contexts (Khara et al, 2018). A number of studies also show that wasting, stunting and concurrent wasting and stunting are all more prevalent in boys than girls, and in younger children between 12 and 30 months of age.

Mortality implications of concurrent wasting and stunting

Children with concurrent wasting and stunting have been shown to have a 12-fold increased risk of mortality compared with children who are not wasted or stunted (McDonald et al, 2013). This highlights the need to focus on considerations around the risk of death within treatment programmes.

Wasting treatment outcomes and stunting

The findings regarding the response to SAM treatment for children who are both wasted and stunted are inconsistent although, overall, evidence suggests that outcomes are suboptimal for children with concurrent wasting and stunting. Treatment programmes should be optimised to identify those children most at-risk. Research is needed to determine if the treatment of wasting could be adapted to better lay the foundation for linear growth.

Anthropometric indices and the identification of risk

Research is ongoing into the most effective identification of children at high risk of mortality. Evidence suggests that the combined use of weight-for-age z-scores (WAZ) and mid-upper arm circumference (MUAC) identifies all near-term deaths (i.e., within six months of measurement) associated with concurrent wasting and stunting.

The use of MUAC and WAZ is also effective in identifying high-risk infants under six months of age. This has important implications in reaching the most vulnerable children in a way that is programmatically practical. These findings indicate the need for further operational research into the most optimal anthropometric identification and assessment of undernutrition.

Conclusion

A significant and still-growing body of evidence supports the existence of a strong relationship between wasting and stunting with important implications for policy and practice. Wasting and stunting, driven by common factors, frequently occur in the same child, either at the same time or through their life course, with important interactions between them. This demonstrates the need for a more integrated approach to prevention and treatment strategies in order to interrupt this process and halt the spiralling of vulnerabilities associated with early growth deficits. To

achieve this, further progress is needed to overcome the divide in undernutrition policy, programme, financing and research initiatives.

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Research Summary

Understanding sex differences in childhood malnutrition

This is a summary of the following paper:

Thurstans S, Opondo C, Seal A, Wells J, Khara T, Dolan C et al (2021) *Understanding sex differences in childhood undernutrition: A narrative review*. *Nutrients*, 14, 5, 948. <https://www.mdpi.com/2072-6643/14/5/948>

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oped at birth and potentially better able to withstand adverse conditions.

Male foetuses are, on average, larger than female foetuses between the eighth and twelfth week of gestation, suggesting that a genetic mechanism may underlie sex differences in foetal size. It is thought that male foetuses grow faster in the womb from the early stages of gestation and that males' placentas may be more 'efficient' than those of females. Male placentas are smaller – by ratio to birthweight – to accommodate a larger foetus in the womb and so male placentas potentially have reduced reserve capacity (Eriksson et al, 2010). This accelerated growth may be beneficial in the presence of an abundant food supply but this makes males vulnerable to food shortages.

Similarly, evidence suggests that male foetuses are more responsive to a mother's gestational diet than female foetuses for whom development seems more closely associated with the mother's longer-term nutritional status. Findings from a study conducted in Nepal showed that in a population with high levels of maternal undernutrition, mothers of sons did not demonstrate greater nutrition reserves to meet the extra absolute energy costs of nourishing males when compared to females (Saville et al, 2021). Thus, boys demonstrated higher rates of stunting and lower head girths during early life.

Endocrine/immune factors

Overall morbidity and mortality rates are higher in males compared to females throughout life. One explanation for this is a stronger immune response and capacity to produce antibodies in girls. Hormonal systems also differ between boys and girls and the interaction between sex hormones and environmental factors has consequences for energy consumption, nutritional requirements and vulnerability to infectious and non-communicable diseases.

Infant and young child feeding

Methods of infant feeding have consequences for growth and development with some evi-

Background

A recent systematic review and meta-analysis on sex differences in malnutrition in children under five years of age (Thurstans et al, 2020) found that, in most settings, boys were more likely to be wasted, stunted and underweight than girls. This research summary aims to understand the possible origins, pathways and consequences of these sex differences which may have implications for policy and practice.

Demographic variations in malnutrition by sex

A recent analysis of Demographic and Health Survey (DHS) data from Africa found that sex differences are more pronounced in children with concurrent wasting and stunting compared with those with only one deficit (Garenne et al, 2021). Sex differences may also be more pronounced among lower socio-economic groups and at higher levels of food insecurity. For example, DHS data from 16 countries in sub-Saharan Africa (Wamani et al, 2007) showed that

sex differences in stunting were more pronounced as socio-economic strata declined. A separate analysis in this review found the difference in prevalence between boys and girls was increased with decreasing wealth so that there was a trend towards less pronounced sex differences in wealthier countries. While the pattern was not uniform, and the comparison would benefit from more in-depth analysis, it suggests that addressing socio-economic inequalities may contribute to reducing sex differences in malnutrition (Figure 1).

Potential explanatory factors for sex differences

Maternal and newborn factors

The observed sex differences appear to originate, at least in part, in utero. Male foetuses are known to be at an increased risk of poor outcomes compared to female foetuses. It is estimated that a newborn female is physiologically similar to a male at four to six weeks of age (Kraemer et al, 2000), suggesting that females are more devel-