

Moderate malnutrition in children aged five years and younger in South Africa: are wasting or stunting being treated?

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Abstract

Objectives: The objective of the study was to describe wasting and stunting in children aged 12-60 months, admitted to targeted supplementary feeding programmes for the treatment of moderate acute malnutrition (MAM) in South Africa.

Design: A cross-sectional, descriptive study was performed.

Subjects and setting: Children with MAM, managed as outpatients at primary healthcare facilities in three provinces, were included in the study conducted between September 2012 and August 2013.

Outcome measures: Weight, height and mid-upper-arm circumference (MUAC) measurements were collected to classify the children as moderately or severely stunted or wasted.

Results: Of the total sample (n = 225), 13% (n = 30) were diagnosed as wasted, 58% (n = 131) as stunted, and 21% (n = 47) as both wasted and stunted. MUAC was significantly associated with wasting. However, an association was not found between MUAC and stunting. Of the sample, 32% (n = 72) presented with severe stunting, and 29% (n = 65) with moderate wasting. Food insecurity was associated with wasting, but not with stunting.

Conclusion: A low weight-for-age z-score resulted more from stunting than from wasting in this study. Severe stunting presented as a greater health concern than moderate wasting. Without scrutinising wasting and stunting, healthcare professionals may remain unaware of the drivers of underweight for age in children treated at South African primary healthcare facilities. Following this study's outcomes, the sensitivity of MUAC in screening for moderate malnutrition in South African settings with a high prevalence of stunting is questionable. It is recommended that current nutritional interventions are revisited to explore the efficacy of treating children with wasting, stunting or both.

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Introduction

Childhood wasting and stunting are important risk factors which contribute to illness and increased mortality in children aged ≤ 5 years. Thus, wasting and stunting contribute significantly to the global disease burden.¹ Malnutrition is also associated with inadequate child development. Poor growth during pregnancy and the first two years of life, especially in combination with economic and non-economic shocks, may result in irreversible damage, and thus impact on children's cognitive abilities at the age of school enrolment.² According to the South African National Health and Nutrition Examination Survey (SANHANES-1),³ the prevalence of undernutrition, and especially wasting, in children aged ≤ 10 years has decreased in South Africa. However, severe stunting in children aged 1-3 years has increased by more than 30% and remains a public health concern.³ Stunting prevalence is influenced by socio-economic factors to a large extent. Greater socio-economic inequalities also appear to exist in countries with a high prevalence

of stunting, which further impacts on the development of stunting in children.⁴ Boys appear to be more likely to be stunted than girls in sub-Saharan Africa.⁵

Although South Africa is food secure at national level, more than half of households in the country experience, or are at risk of, hunger.³ Recent increases in fuel and food prices, including staples, can negatively impact on food security, especially in urban areas.⁶ Stunting or linear growth retardation is associated with a long-term inadequate diet and/or infection burden.¹ A change in environmental conditions is needed in order to reverse stunting.⁷

The association between stunting and wasting recently started to receive more attention. Khara and Dolan⁸ warn that children who are severely wasted or stunted are respectively 11.6 and 5.5 times more likely to die than children with a normal weight and height. Moderately wasted children are 3.4 times more likely to die than well nourished children, compared to a 2.3 times higher mortality

risk in moderately stunted children.⁸ Children with both wasting and stunting have an even higher mortality risk and are 12.3 times more likely to die than healthy children. Therefore, children with severe stunting seem to have a higher mortality risk than children with moderate wasting. Although the prevalence of wasting in South Africa has decreased, the high prevalence of stunting still poses an important health challenge, which needs to be addressed in order to reduce the burden of disease and to save lives.

According to the Roadmap for Nutrition 2013-2017,⁹ current intervention strategies in South Africa allow for targeted supplementation in children aged 6-59 months for the purposes of preventing or treating moderate malnutrition. Multiple micronutrients, enriched maize blends, ready-to-use therapeutic food, enriched energy drinks or a combination thereof are used by healthcare professionals to support conventional nutrition counselling methods. However, improving and supporting breastfeeding, improving complementary feeding and encouraging regular visits to healthcare facilities still remains the starting point for any nutrition intervention strategy being implemented. Although it has been recommended that the health system in South Africa should be strengthened by improving key nutrition interventions,⁶ it is necessary to develop a clear understanding of nutrition problems, and how they may impact on the prevention of severe malnutrition or the treatment of moderate malnutrition in South Africa. Questions that authors are asking include: Are children who are admitted to targeted supplementation programmes mostly wasted, stunted or both? What is the prevalence of underlying food insecurity in children with moderate acute malnutrition? Could regular screening of mid-upper-arm circumference (MUAC) facilitate better identification of children with wasting, stunting or both?

The data presented in this paper were part of a larger study that assessed the outcomes of targeted nutrition supplementation in children with moderate malnutrition in South Africa. (One child was excluded because of insufficient data). Only data collected during the baseline study are presented in this paper.

Method

Setting and design

A cross-sectional study design was followed to collect data at primary healthcare clinics in three health districts, including the Western Cape, Free State and Northern Cape provinces. Data collection took place between September 2012 and August 2013. The legal guardians (parents or caregivers) of children aged 12-60 months, classified as moderately malnourished, i.e. with a weight-for-height z-score between -2 and -3 standard deviation (SD), according to the World Health Organization (WHO) standard, or with height for age less than -2 SD of the WHO standard, were invited to allow their children to participate.

Measures

Data pertaining to demographic information, household food security and child hunger, the presence of underlying illness, including human immunodeficiency virus (HIV) and tuberculosis, as well as weight, height and MUAC, were collected.

The children were weighed using a calibrated Seca[®] paediatric scale, accurate to the nearest 10 g. They were weighed while wearing minimal clothing, and without a nappy and shoes. The scale was placed on a hard surface. The child was placed in the middle, and kept still until the measurement had been taken.

A measuring mat, accurate to 0.1 cm, was used to measure the length of the children aged ≤ 24 months. The measuring mat was placed on a flat surface in order to obtain an accurate measurement. A trained dietitian and a trained nurse or community health worker at each of the sites worked together to take and record accurate measurements. The measurement was taken when the infant's head was level with the headboard in the Frankfurt plane and with the child's flexed heel placed against a footboard. The measurement was taken at eye level. Three length measures were taken, and the average calculated and recorded.¹⁰

The MUAC was measured by the researchers using a MUAC[®], Child 11.5 Red measuring tape, with accuracy to the nearest 1 mm. MUAC was measured on the left upper arm, at the mid-point between the olecranon process and the acromium, as determined when the arm is in a flexed position. The MUAC was measured at this point after relaxing the arm along the side of the body with the measuring tape fitting snugly, but without making a dent in the upper arm.¹⁰

Child hunger was determined by asking the mother or caregiver eight questions based on simplified questions taken from the Household Hunger Scale (HHS), where a "yes" answer indicated food insecurity.¹¹ This HHS was developed from the Household Food Insecurity Access Scale which was validated by the Food and Nutrition Technical Assistance III Project for cross-cultural use in developing countries.¹¹ During the pilot study, respondents experienced difficulty answering the frequency-of-occurrence questions. For this reason, data collection was simplified to allow for "yes" and "no" answers. The questions were asked according to the experience of the respondents in the previous month. Interpretation was subsequently simplified to categorise households as "food insecure or hungry", "at risk of hunger" or "food secure" for the purposes of the study. A score of ≥ 5 , i.e. five "yes" responses out of a maximum possible of eight, indicated that a food security issue affected the household. These families were considered to be "hungry". A score of 1-4 indicated that the family was at "risk of hunger". A household was considered to be food secure if a "no" response was obtained to all of the questions.

Procedures

Ethical approval for the study was obtained from the Human Research Ethics Committee, Nelson Mandela Metropolitan University (H12-RTI-HIV-003). Six registered dietitians working in primary healthcare clinics in the three provinces were recruited as fieldworkers, and provided with measuring equipment and a protocol to take measurements and to conduct the study. The dietitians were trained by the researchers to collect the data and ensure standardised completion of the questionnaire. Anthropometric measurements were collected by one of the trained dietitians, together with a trained nurse or community health worker. Children who were identified with moderate acute malnutrition at the clinics included in this study were purposefully selected according to the inclusion criteria for the targeted supplementation feeding programme. Children were

Table 1: Descriptive statistics pertaining to the nutritional status of the sample

Measurements	Total sample	Normal nutritional status	Underweight for age	Wasted	Stunted	Both wasted and stunted
	n = 225	n = 17	n = 155	n = 30	n = 131	n = 47
WAZ						
↓ 95% CI	-2.57	-1.81	-2.98	-2.70	-2.33	-3.58
χ^2	-2.46	-1.53	-2.89	-2.55	-2.20	-3.44
↑ 95% CI	-2.35	-1.25	-2.79	-2.41	-2.07	-3.30
SD	0.85	0.55	0.59	0.38	0.74	0.49
HAZ						
↓ 95% CI	-2.81	-1.91	-2.98	-1.60	-3.12	-3.28
χ^2	-2.69	-1.72	-2.82	-1.37	-2.97	-3.07
↑ 95% CI	-2.56	-1.53	-2.66	-1.14	-2.83	-2.86
SD	0.98	0.38	1.02	0.62	0.85	0.73
WHZ						
↓ 95% CI	-1.57	-0.32	-2.05	-2.79	-0.94	-2.75
χ^2	-1.43	-0.87	-1.92	-2.61	-0.81	-2.61
↑ 95% CI	-1.28	-0.43	-1.79	-2.43	-0.67	-2.47
SD	1.10	0.87	0.82	0.48	0.77	0.48
MUAC (cm)						
↓ 95% CI	13.75	13.97	13.38	13.22	14.11	12.63
χ^2	13.90	14.60	13.54	13.53	14.28	12.83
↑ 95% CI	14.05	15.23	13.69	13.84	14.45	13.04
SD	1.11	1.23	0.98	0.83	0.98	0.71

CI: confidence interval, HAZ: height-for-age z-score, MUAC: mid-upper-arm circumference, SD: standard deviation, WAZ: weight-for-age z-score, WHZ: weight-for-height z-score, χ^2 : sample mean

subsequently included in the study after written informed consent was obtained from the legal guardians. A pilot study to test the questionnaire and procedures was conducted at a local clinic in the Kouga Local Municipality. The data were not included in the final study.

Data to indicate gender for one child in the sample was missing, so this child was excluded from the data analysis. The anthropometrical data pertaining to the total remaining sample (n = 225), including the date of birth, date of survey, gender, weight (kg) and length or height were captured twice on an Excel® spreadsheet to ensure accurate data entry. The age was subsequently calculated in days, and divided by 30.4375 in order to arrive at an age in months (to the nearest four decimals), which is comparable to the WHO standard for children aged ≤ 60 months.

Data analysis

Data were analysed using Predictive Analytics SoftWare® by SPSS®, version 22, and SAS®/STAT® software, version 12.3 of the SAS® System for Windows®. Frequencies and percentages were used to describe categorical data. Z-scores below -5 were not included in the comparison. A comparison of means was performed using Student's t-test. The χ^2 test and two-tailed Pearson's correlation coefficient were used to describe and test associations and correlations between variables. A p-value of ≤ 0.05 was considered to be statistically significant.

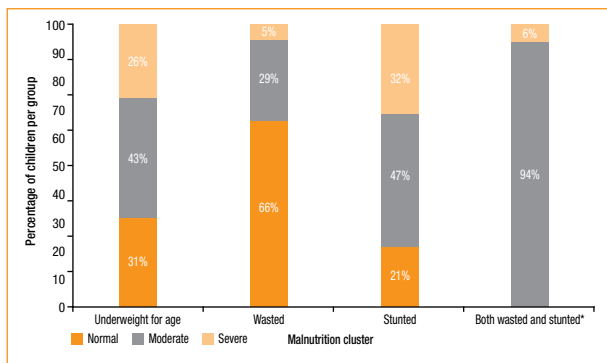
Results

Two hundred and twenty-five children were included in the study, of whom 113 (50%) were male. The mean age of the children was 29.3

months (SD = 13.5). Less than 6% of the children were affected by either a father or mother who had passed away. Although HIV testing did not occur as part of this study, 7% of the children were known to be HIV infected.

Children in the sample (n = 225) were included with a mean weight-for-age z-score (WAZ) of -2.46, a mean height-for-age z-score (HAZ) of -2.69, a mean weight-for-height z-score (WHZ) of -1.42, and a mean MUAC of 13.9 cm (Table 1). Of the total sample admitted, 69% (n = 155) were underweight for age, 79% (n = 178) were stunted, and 34% (n = 77) wasted. Further analysis indicated that 13% (n = 30) of the children were wasted only, 58% (n = 131) stunted only, and 21% (n = 47) both wasted and stunted. A significant difference in nutritional status could not be demonstrated between the two genders. Almost 8% (n = 17) of the children's WHZ was plotted to be just below -2, according to the Road to Health booklet's WHZ chart. However, it became evident after data analysis that the children's WHZ at baseline was in fact above -2. Therefore, for the purposes of this paper, these children were classified as having a normal nutritional status (WHZ > -2 SD), as illustrated in Table 1.

The data subset was subsequently analysed according to moderate and severe wasting and stunting (Figure 1). Of the total sample, 29% (n = 65) were moderately wasted, and 5% (n = 12) severely wasted. However, 47% (n = 106) presented with moderate stunting, and 32% (n = 72) with severe stunting. Of those who were both stunted and wasted, 20% (n = 44) were moderately malnourished on both accounts, and only 1% (n = 3) severely malnourished.



* Children in this bar may be represented in the wasted or stunted bars as well

Figure 1: Moderate and severe malnutrition per cluster

A significant positive association was reported between MUAC and WHZ (χ^2 of 27.8, p-value < 0.001). However, Cramer's V (0.25) indicated that this finding was of small practical importance. Of the sample, 30% ($n = 60$) of the children were identified with a WHZ < -2 , but a MUAC measurement > 12.5 cm. A MUAC < 12.5 cm, but a WHZ > -2 , was recorded in only 4% ($n = 6$) of the children in the sample. A significant association was not noted between the MUAC and HAZ (χ^2 of 6.31, p-value 0.177). More importantly, 59% ($n = 61$) of the children with a MUAC measurement > 12.5 cm (normal) were severely stunted (HAZ < -3), while a MUAC measurement < 12.5 cm was recorded in only 15% ($n = 11$) of the children with severe stunting. Given the poor sensitivity of MUAC in identifying MAM patients according to WHZ and/or HAZ cut-offs, the researchers have not reported on the relative risk of patients with an abnormal WHZ or HAZ in presenting with MAM.

Of the total sample, only 30% ($n = 76$) of the children were classified as being food secure, i.e. without any "yes" answers to the food security questions. The majority of the children ($n = 83$, 37%) were classified as food insecure or hungry, while 32% ($n = 72$) were classified as being at risk of hunger. A significant association was demonstrated between food insecurity and wasting (χ^2 of 16.9, p-value 0.002). However, a significant association was not found between food insecurity and stunting.

Discussion and recommendations

Malnutrition in South Africa is still considered to be a major factor impeding the achievement of the Millennium Development Goals.¹² Apart from malnutrition risk, poor nutritional intake is associated with an increased prevalence of respiratory tract infections, diarrhoea, fever and poor appetite in children, widely regarded as the conditions responsible for most mortalities in infants aged ≤ 5 years.¹³

It is well-known that severe wasting is strongly associated with increased mortality in children aged ≤ 5 years.¹⁴ Children were screened by dietitians in this study for inclusion in a targeted supplementary feeding programme. From the results, it was evident that stunting was a much larger driver of underweight for age than wasting. Severe stunting was present in more children than moderate wasting. Approximately a third of the sample was severely stunted. The implication is that these severely stunted children potentially have a mortality risk of 5.5 times that of children with normal growth.⁸

Most attending healthcare professionals are often not fully aware of the risks associated with stunting, probably because of the absence of obvious clinical signs of wasting in stunted children. Length and height measurements are not routinely taken at most growth monitoring and promotion sites, or even at primary healthcare facilities.¹⁵ Thus, the identification of severe stunting in South Africa is not yet routinely performed and reported.

The correct interpretation of WAZ, and especially WHZ and MUAC, by healthcare professionals is crucial to ensure the optimal management of children at risk of severe malnutrition. However, it was demonstrated from recent data that nurses in the Western Cape had inadequate knowledge of the use of available nutritional status interpretation tools in the Road to Health booklets.¹⁶ Simplifying nutritional screening by using MUAC alone to identify high-risk, malnourished children has been described by Briend et al.¹⁷ They found MUAC to be an acceptable screening tool in identifying children with severe acute malnutrition, with no benefit using WHZ in combination with MUAC or MUAC alone. MUAC has also been described by Goossens et al.¹⁸ to have many advantages over the use of WHZ. However, the researchers in this study found that of the children with MAM, an acceptable MUAC measurement of > 12.5 cm was found in a large proportion of the sample, despite a WHZ lower than -2 SD having been recorded. This is in line with other international studies which, in conflict with the recommendations by Briend et al.¹⁷ and Goossens et al.,¹⁸ showed a poor correlation between WHZ and MUAC.^{19,20} Thus, the sensitivity of MUAC in screening for MAM in South African populations with high levels of moderate and severe stunting should be questioned. Studies on a larger sample size, across more provinces in South Africa, are needed to further assess this trend.

When investigating the root of the malnutrition problem in this study population, the large number of children (37%) living in food-insecure households poses an important health challenge which needs to be addressed. These figures are similar to recent data from the SANHANES-1 study,³ which indicated that 32% of people in informal settlements in South Africa experience hunger. However, food insecurity could not be associated with stunting in this study. Causes of poor skeletal growth should be investigated further. The early and effective identification and treatment of stunting should be seen as a priority in the healthcare sector. Retraining all healthcare professionals with respect to how to take accurate length and height measurements should be a focus area for staff in the integrated nutrition programme. A low WAZ is mainly used in the public sector as an entry criterion to a supplementation programme. The contribution of stunting is often not considered in this regard. The earlier identification of stunting and successful treatment is only possible if all healthcare workers are trained to weigh and measure, as well as interpret, both WHZ and HAZ as part of routine screening at all growth monitoring and promotion sites. However, the challenge behind early screening and treatment remains dependent on available adequate resources. This is often not found to be the case.¹⁵ By investigating the involvement of other sectors, i.e. early childhood development centres for routine nutritional screening,²¹ the necessary awareness can be created, not only to share the responsibility of growth monitoring with teachers and parents, but also to permit remedial measures to be implemented sooner.

When addressing the question as to whether or not nutritional intervention strategies should be the same as those for wasted and stunted children in the current targeted nutrition supplementation programme, several factors need to be considered. High-fat, energy-dense supplements, including lipid-based ready-to-use therapeutic foods, are thought to be more effective in achieving catch-up growth in wasted children. However, linear growth has also improved in infants receiving long-term dietary supplementation with lipid-based spreads in vulnerable communities.^{22,23}

A distinction is not made between the treatment approaches to wasted and stunted children in South Africa. The treatment of MAM within the current targeted supplementation programme does not permit the long-term blanket supplementation of vulnerable infants to assess whether or not severe stunting can be prevented. The relationship between the rate of catch-up growth in children aged ≤ 2 years and the risk of obesity later in childhood should be considered when reversing stunting. The increased rate of catch-up growth has been described to continue into adolescence and adulthood,²⁴ and is blamed as the reason behind the increasing burden of obesity. On the other hand, stunting and wasting normally have overlapping periods, while optimal skeletal growth is dependent on steady weight gain;²⁵ often not viable in vulnerable communities. In the absence of blanket food supplementation for high-risk children at early childhood development centres, adapted food supplementation to provide more nutrients to support skeletal growth, i.e. protein and calcium, but less energy, for a longer period than that used with the current approach, may be more effective in preventing the excessive weight gain against which researchers warn.

However, the early screening and identification of children born as, or at risk of becoming, underweight or stunted, should still be considered the best means of combating the problems arising from current intervention strategies, and in the long term, of addressing the nutritional double burden of disease.

Limitations

The authors acknowledge that a cross-sectional study design is not the best way in which to assess an association between anthropometrical measurements. Stunting is normally associated with episodes of wasting, and the researchers had no way of determining the history of episodes of wasting in participants admitted with stunting. The assessment of growth data in South Africa should be a priority so so that these trends can be further analysed.

Declaration

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