Selected facets of nutrition during the first 1 000 days of life in vulnerable South African communities

I M du Plessis,1 PhD; M G Herselman,2 PhD; M H McLachlan,1 PhD; J H Nel,3 PhD

1 Division of Human Nutrition, Faculty of Medicine and Health Sciences, Stellenbosch University, Cape Town, South Africa
2 Department of Logistics, Faculty of Economic and Management Sciences, Stellenbosch University, Cape Town, South Africa
3 Corresponding author: I M du Plessis (lmdup@sun.ac.za)

Background. Optimal nutrition during the first 1 000 days of life can reap lasting benefits throughout life.

Objectives. To assess infant and young child-feeding (IYCF) practices and mother/caregiver-child anthropometry in two vulnerable Breede Valley communities, Western Cape.

Methods. Mothers of children aged 0 - 23 months (N=322) were interviewed to assess IYCF practices. Anthropometric measurements of mothers/caregivers and children were performed according to standard procedures.

Results. Mothers reported early breastfeeding (BF) initiation in 75.2% (242/322) of cases. Of infants <6 months old, 38.5% (45/117) were recorded as exclusively breastfed (EBF). Cross-checking this figure with other research from the area, however, suggests significant over-reporting of EBF. One in five infants <6 months were exclusively bottle fed (19.7%; 23/117) and 48.4% (156/322) aged 0 - 23 months had received bottle feeding in the preceding 24 hours. Eighty-four percent (36/43) of 6 - 8-month-old infants were receiving complementary foods. BF was continued in 32.5% (13/40) of children 12 - 15 months old. In children 6 - 23 months, 44.0% (90/205) received foods from four or more food groups, 71.0% (145/205) received complementary foods the recommended minimum number of times or more, and 44.4% (91/205) received a minimum acceptable diet.

The prevalence of stunting and overweight in children was 28.9% and 21.8%, respectively. The prevalence of overweight in mothers/caregivers was 28.9%, and 33.7% were obese, with a mean waist circumference of 88.6 cm.

Conclusion. Indicators showed sub-optimal IYCF practices with child under- and overnutrition coexisting with maternal/caregiver overweight. This profile signals a need for urgent and appropriate interventions focusing on the first 1 000 days of life.
The Community-Based Nutrition Security Project (CNSP) of the Division of Human Nutrition, Stellenbosch University, investigated the community food security situation in two vulnerable communities (Avian Park and Zweletemba) in the Breede Valley sub-district, Western Cape Province. This baseline survey provided an opportunity to investigate IYCF practices at household level in this area.

The main objective of this sub-section of the CNSP baseline survey was to assess the feeding practices of infants and children aged 0 - 23 months with the core WHO validated indicators. The IYCF practices will be discussed within the context of selected anthropometric measurements of mother/caregiver-child pairs.

Methods
Study design and sample selection
A descriptive cross-sectional study was conducted. The sampling frame of the CNSP baseline survey consisted of all households within the selected communities. A simple random selection of households was performed. Households with young children (0 - 36 months) were the basic unit for selection and assessment in the CNSP study. A qualifying household was defined as ‘any household with at least one child (0 - 36 months) and mother/primary caregiver pair’. Age was verified with a birth certificate or Road-to-Health Booklet (SA tool to assess and monitor the health status of children younger than 5 years). In situations where more than one household lived at an address and both households had a qualifying mother/primary caregiver-and-child pair, participation was determined through random selection. The same procedure was followed if more than one child of the same mother/primary caregiver qualified for inclusion.

Households with infants or children between the ages of 0 and 36 months, who resided in Zweletemba or Avian Park for at least 27 weeks of the year, were eligible for inclusion.

Sample size
A power analysis on one-way analysis of variance (ANOVA) with a 5% significance design provided 90% power with a sample size of 170 per group (two groups in two areas). To allow for a response rate of 85%, the total sample size was calculated at 200 per group per area. The final, slightly oversampled, sample size of the CNSP study was 443 mother/primary caregiver and child pairs. For the focus of this article, complete data were captured for 322 infants/young children in the age range 0 - 36 months (n=117 aged 0 - 6 months; n=205 aged 6 - 23 months), and a total of 312 for the mothers/caregivers.

Methodology
The complete methodology of the CNSP baseline survey is described in the parent protocol (Ethics Committee Ref No: N10/11/368).

The assessment of IYCF practices for children aged 0 - 23 months as well as a description of selected demographic and anthropometric data for these children and their mothers/caregivers is provided here.

<table>
<thead>
<tr>
<th>Definition of indicator</th>
<th>Calculation</th>
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<tbody>
<tr>
<td>Early initiation of breastfeeding: Proportion of children born in the last 24 months who were put to the breast within 1 hour of birth</td>
<td>Children born in the last 24 months who were put to the breast within 1 hour of birth</td>
</tr>
<tr>
<td>Exclusive breastfeeding under 6 months: Proportion of infants 0 - 5 months of age who are fed exclusively with breastmilk</td>
<td>Children born in the last 24 months</td>
</tr>
<tr>
<td>Continued breastfeeding at 1 year: Proportion of children 12 - 15 months of age who are fed breastmilk</td>
<td>Children 12 - 15 months of age who received breastmilk during the previous day</td>
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<tr>
<td>Introduction of solid, semi-solid or soft foods (complementary foods): Proportion of infants 6 - 8 months of age who receive solid, semi-solid or soft foods</td>
<td>Children 6 - 15 months of age who received solid, semi-solid or soft foods during the previous day</td>
</tr>
<tr>
<td>Minimum dietary diversity: Proportion of children 6 - 23 months of age who receive foods from 4 or more food groups</td>
<td>Children 6 - 23 months of age who received foods from ≥ 4 food groups during the previous day</td>
</tr>
<tr>
<td>Minimum meal frequency: Proportion of breastfed and non-breastfed children 6 - 23 months of age who receive solid, semi-solid, or soft foods (but also including milk feeds for non-breastfed children) the minimum number of times or more</td>
<td>Breastfed children 6 - 23 months of age who received solid, semi-solid or soft foods the minimum number of times or more during the previous day</td>
</tr>
<tr>
<td>Minimum acceptable diet (summary infant and young child feeding indicator): Proportion of children 6 - 23 months of age who receive a minimum acceptable diet (apart from breastmilk)</td>
<td>Breastfed children 6 - 23 months of age and Non-breastfed children 6 - 23 months of age who received solid, semi-solid or soft foods or milk feeds the minimum number of times or more during the previous day</td>
</tr>
<tr>
<td>Consumption of iron-rich or iron-fortified foods: Proportion of children 6 - 23 months of age who receive an iron-rich food or iron-fortified food that is specially designed for infants and young children, or that is fortified in the home</td>
<td>Breastfed children 6 - 23 months of age and Non-breastfed children 6 - 23 months of age who received at least 2 milk feedings and had at least the minimum dietary diversity not including milk feeds and the minimum meal frequency during the previous day</td>
</tr>
<tr>
<td></td>
<td>Non-breastfed children 6 - 23 months of age</td>
</tr>
<tr>
<td></td>
<td>Children 6 - 23 months of age who received an iron-rich food or a food that was specially designed for infants and young children and was fortified with iron, or a food that was fortified in the home with a product that included iron during the previous day</td>
</tr>
</tbody>
</table>
IYCF questionnaire
A one-page questionnaire consisting of ten questions was formulated based on the wording of the eight WHO-validated IYCF core indicators[9] (Table 1; column 1). It also included two questions on bottle-feeding from the optional indicators. The questionnaire had to be administered time-efficiently, since the anthropometric measurements and interviews (including sociodemographic questionnaire, household food insecurity access scale, food frequency questionnaire, hunger questionnaire and a dietary diversity questionnaire for mothers and children) of the broader CNSP baseline survey took approximately 2 hours to complete.

All questions were based on recall of the previous day, except for ’breastfeeding initiation’ which was based on historic recall and ’Does your baby receive any of the following (iron sources)’ which was based on usual practice. The age range for the questions was 0 - 23 months, divided into specific monthly intervals, as appropriate to capture information and percentages.

Children's ages, weights and heights were used to calculate length/height-for-age z-scores (HAZ), weight-for-age z-scores (WAZ), weight-for-length/height z-scores (WHZ) and body mass index (BMI)-for-age z-scores (BAZ) using WHO Anthro (version 3.2.2) software (StatSoft, 2013, USA).[20] Data were interpreted using WHO child growth standards and cut-off values[21] (Table 2).

Adult women's BMI (weight (in kg)/height (in m²)) was interpreted using the WHO Consultation on Obesity classification (1999), i.e. underweight (BMI <18.5 kg/m²), normal weight (BMI = 18.5 - 24.99 kg/m²), overweight (BMI = 25 - 29.99 kg/m²) or obese (BMI ≥30 kg/m²) as well as waist circumferences with a cut-off point of 88 cm indicating a substantially increased risk of metabolic complications.[22] The cut-off used for maternal short stature is a height measurement of <1.45 m.[23]

Training of fieldworkers, pilot study and data collection
Women were recruited from the two communities included in the study to act as fieldworkers. These fieldworkers were trained and standardised to administer the IYCF questionnaire, together with other questionnaires within the broader CNSP survey.

Height/length and weight measurements of children and the weight, height and waist circumference (WC) measurements of mothers/primary caregivers were taken by two dietitians aided by two trained assistants, according to standard procedures.[24][25]

A pilot study was conducted in March 2011 over a period of 1 week in order to test the face and content validity of all the questionnaires. Data collection took place between March and July 2011. During data collection, questionnaires were checked for completeness and accuracy by CNSP research staff.

Data analysis
Data were captured in Microsoft Excel and analysed using SAS 9.3 (2002 - 2010) (SAS Institute Inc., USA).[19] IYCF indicators were calculated as prescribed in the ’Indicators for assessing infant and young child feeding practices: Part I’ (Table 1; column 2) document.[9] Demographic data and indicators were described using means, standard deviations and percentages.

Results
Selected demographic and anthropometric data of mothers and children
The average age (standard deviation (SD)) of the mothers/caregivers of children aged 0 - 23 months was 29.5 (9.67) years and that of the children was 9.85 (7.11) months. Of the mothers/caregivers, 89.1% (278/312) were the children's biological mothers and 10.9% were caregivers (grandmothers/day-mothers).

The mean (SD) BMI of mothers/caregivers was 28.52 (7.98) kg/m². The prevalence of underweight was 4.2%; normal weight was 33.3%; overweight was 28.9% and obesity 33.7%. The mean (SD) waist circumference was 88.6 (16.89) cm in mothers/caregivers of children aged 0 - 23 months. Mean (SD) maternal/caregiver height was 1.56 (0.073) m.

The prevalence of stunting, underweight, wasting and overweight (Table 2) in children aged 0 - 23 months was 28.9%, 4.8%, 0.96% and 21.8%, respectively.

Infant and young child feeding (IYCF) practices
Breastfeeding initiation within 1 hour after birth was calculated to occur in 75.2% (n=242/322) of the sample. Thirty-eight and a half percent (38.5%; n=45/117) of the infant population younger than 6 months was recorded as being exclusively breastfed (EBF). Breastfeeding was continued in 32.5% (n=13/40) of babies 12 - 15 months of age.

Nearly 20% of babies 0 - 6 months of age received exclusive bottle feeding (19.7%; 23/117), while 48.4% of babies aged 0 - 23

Table 2. Description and prevalence of nutritional disorders in children 0 - 23 months old

<table>
<thead>
<tr>
<th>Nutritional disorder</th>
<th>Description*</th>
<th>Children (N=312), n (%)¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stunting</td>
<td>Length/height for age z-score (HAZ) of ≤ −2 SD of the WHO child growth standard median</td>
<td>93 (28.81)</td>
</tr>
<tr>
<td>Underweight</td>
<td>Weight for age z-score (WAZ) ≤ −2 SD of the WHO child growth standard median</td>
<td>15 (4.81)</td>
</tr>
<tr>
<td>Wasting</td>
<td>Weight for length/height z-score (WHZ) ≤ −2 SD of the WHO child growth standard median</td>
<td>3 (0.96)</td>
</tr>
<tr>
<td>Overweight</td>
<td>Weight for length/height z-score (WHZ) ≥ +2 SD of the WHO child growth standard median</td>
<td>68 (21.79)</td>
</tr>
</tbody>
</table>

*Source for description: De Onis et al.[21]

¹Number of children (N=312) differs from total number of data for 0 - 23 month old babies (N=322), because anthropometric measurements were not possible in 10 children.

Table 3. Dietary diversity scores of children, reported for five age categories (N=307)

<table>
<thead>
<tr>
<th>Age categories (months)</th>
<th>Children, n</th>
<th>Dietary diversity scores, mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 - 12.9</td>
<td>307</td>
<td>4.16 (1.61) 3.26 (1.35) 4.43 (1.53) 4.60 (1.62) 3.91 (1.56)</td>
</tr>
<tr>
<td>13 - 23.9</td>
<td>87</td>
<td></td>
</tr>
<tr>
<td>23.9 - 35.9</td>
<td>108</td>
<td></td>
</tr>
<tr>
<td>35.9 - 62.9</td>
<td>112</td>
<td></td>
</tr>
<tr>
<td>6 - 23.9</td>
<td>195</td>
<td></td>
</tr>
</tbody>
</table>
months received bottle feeding in the preceding 24-hour period (156/322).

Eighty-four percent (36/43) of infants 6 - 8 months of age received solid, semi-solid or soft foods. The proportion of children 6 - 23 months of age who received foods from four or more food groups was calculated at 44.0% (90/205). These food groups included: (i) grains, roots, tubers (e.g. bread, cereal, cooked porridge or potato); (ii) legumes and nuts; (iii) dairy products, excluding breastmilk (milk, yoghurt, cheese); (iv) meat, fish, poultry and liver/organ meat; (v) eggs; (vi) vitamin A-rich fruit and vegetables (sweet potato, carrots, pumpkin, butternut, spinach, broccoli, apricot, peach, mango); and (vii) other fruits and vegetables.

Just over 70% of breastfed and non-breastfed children aged 6 - 23 months received solid, semi-solid, or soft foods (but also including milk feeds for non-breastfed children) the recommended minimum number of times or more per day (70.7%; 145/205). Forty-four percent of children 6 - 23 months of age received an iron-rich food/s, 42.4% (87/205) receiving a multivitamin containing iron and 53.2% (109/205) receiving baby cereal or foodstuffs manufactured for babies containing iron.

**Discussion**

In this sub-section of a larger research project, sub-optimal IYCF practices and poor anthropometric profiles were found in mother/caregiver-child pairs in two vulnerable communities in the Breede Valley, Western Cape Province.

Early initiation of breastfeeding in newborn babies at 75% was lower than the national figure of 88%, but corresponds with data derived from a sub-study of the CNSP, where 77% of mothers with babies aged 0 - 6 months reported initiating breastfeeding early.[24] Early initiation of breastfeeding holds many documented benefits,[25] and should be a supported practice at various points of contact with pregnant mothers, including in antenatal clinics and maternity wards.[26]

When the very low average EBF rate for SA (8%) is considered,[13] the reported EBF rate in this study, of more than a third of babies aged younger than 6 months, probably better reflects predominant and partial breastfeeding.[14] Similarly, when the data gathered from the IYCF questionnaire were checked for consistency against data derived from a dietary diversity questionnaire (DDQ), administered to mother/caregiver-child pairs within the broad CNSP baseline study, 35% of babies aged younger than 6 months were recorded as being EBF. However, a more in-depth assessment of breastfeeding practices in the younger age group (0 - 6 months) in the same communities suggests significant over-reporting of EBF with both the DDQ and the WHO indicator.[24] Previous work in SA has shown that the term 'EBF' was not well understood or practised.[27,28] In this study area it is possible that the term was either not well understood or participants reported on what they think should be done rather than their own practices. Furthermore, it is acknowledged that the EBF indicator lacks sensitivity (i.e. it commonly may classify children as EBF who may have received non-breastmilk liquids or foods prior to the survey) and therefore overestimates the proportion of EBF infants.[29] This overestimation of EBF rates by 1-day recall measures has been observed previously.[29] In-depth questioning around this specific aspect of infant feeding should therefore be stressed in field research for calculation of this indicator.

Only about a third of babies were reported as still being breastfed at 12 - 15 months of age, falling far short of the WHO recommendation of continued breastfeeding up to two years of age and beyond.[30]

One in five babies received bottle feeding from birth and were never breastfed, and almost half of babies aged 0 - 23 months received bottle feeding during the previous 24 hours. Bottle feeding does not provide a safe alternative to breastfeeding in SA, mainly because of poor caregiver knowledge and education, as well as a lack of resources that result in poor hygiene and suboptimal IYCF practices.[15] Furthermore, the development of undernutrition as well as overweight and obesity has also been linked to formula feeding, with practices of dilution and overconcentration/overfeeding, respectively.[18,20]

Infants between 6 and 8 months of age should be receiving solid, semi-solid or soft foods; however, about a third of babies in this study did not receive complementary foods in the preceding 24 hours. Almost half of the children 6 - 23 months of age received a diverse diet of minimum acceptability. The mean dietary diversity score (DDS) for children 6 - 35 months, calculated from the broader CNSP dataset was 4.16, indicating a diet of adequate diversity (Table 3).

However, in the age group 6 - 12 months the DDS was 3.26, and in the age group 6 - 23 months the DDS was 3.91. Both these values are below a score of 4, indicating insufficient dietary diversity.[15] This corresponds with the low percentage of children aged 6 - 23 months who received foods from four or more food groups, as calculated with the related WHO indicator.

Intake of iron-rich food and/or supplements in the studied communities seems acceptable. These data correspond with SANHANES-1 data, which has attributed this improvement at national level to the SA food fortification programme enacted in 2003.[16] However, the question in the IYCF questionnaire posed to mothers/caregivers in the Breede Valley communities specifically listed the following options for iron-rich food and/or supplements: (i) meat, fish, poultry and liver/organ meats; (ii) baby cereal or special baby food enriched with iron; (iii) multivitamin syrup (containing iron) or iron drops, and did not include bread and maize meal, which are the staple foods fortified by law in SA.[16] Children in the studied communities seem to have adequate dietary iron intake from the mentioned sources.

In the Breede Valley sub-study, anthropometric indices indicated that maternal overnutrition and child undernutrition, particularly stunting, as well as child overnutrition coexisted. A high prevalence of overweight and obesity of mothers/primary caregivers, coupled with a high mean waist circumference, indicates an increased risk for non-communicable diseases. When the IYCF practices and child anthropometric profile are considered together with the maternal anthropometric profile, it is clear that nutritional practices in the first 1000 days of life place the future development, growth and health of children in the Breede Valley in serious jeopardy.

Studies conducted in other provinces of SA also indicated the coexistence of stunting and overweight/obesity in children younger than 5 years of age.[34,35,42] Furthermore, the coexistence of overweight and obesity in mothers/caregivers and undernutrition, particularly stunting, in children has also been reported.[44-45] This presents evidence of a worrying double burden of malnutrition in SA communities undergoing a nutrition transition.[16]

The National Department of Health’s Integrated Nutrition Programme (INP) for SA has focused on furthering the maternal and child nutrition agenda over the past two decades.[46] However, a recent, independently prepared report – *Evaluation of Nutrition Interventions for Children from Conception to Age 5* – highlighted the limited progress SA has made in improving child nutrition over the past 20 years.[47]

The report also states that, although the Departments of Health, Social Development (DSD), Agriculture, Forestry and Fisheries (DAFF) as well as the Department of Rural Development and Land Reform (DRDLR) each have sufficient policies, regulations, and strategies to guide their respective portfolios of nutrition interventions, evidence points to unequal commitment to nutrition across departments with varying levels of leadership, management, planning, budgeting, and staffing.[46]

Various recommendations are made in the report to address the current situation, including elevating the status of the INP within the
national and provincial government structures with a well-developed nutrition plan that includes nutrition output in a delivery agreement across all sectors. It is also recommended that common indicators should be developed for tracking food and nutrition across all sectors with measurable targets over the short, medium, and long term, as well as a consolidated monitoring and evaluation framework for tracking delivery and the effects of nutrition interventions.[48] These recommendations support the collection of data relevant to the construction of the WHO IYCF indicators which should be included in community-based research projects, larger-scale population studies in SA, including the Demographic and Health Survey and follow-on SANHANES, as well as the country’s District Health Information System (DHIS).[28] It has been proposed in the updated SA IYCF policy (2013) that the following indicators should be calculated from information gathered in surveys and the 14-week data through the DHIS: (i) percentage of mothers initiating breastfeeding within 1 hour of birth; (ii) percentage of babies EBF at 14 weeks; and (iii) percentage of infants 0–6 months EBF.[47] The potential to monitor more indicators should be investigated and supported,[48] especially in the light of the recommendations made in the evaluation report.[49]

Study limitations

Although the WHO indicators used to assess IYCF are valid and reliable, the questionnaire used in this study was not validated. This limitation warrants a separate study.

Conclusion

It is of utmost importance to optimise infant nutrition and growth, especially in the first 2 years of life. Although indicators have limitations, they provide a good starting point for decision makers to implement appropriate interventions.[47] IYCF indicators applied to a household survey, among children aged 0–23 months, in the Breede Valley indicated sub-optimal IYCF practices. Anthropometric indices indicated that maternal overnutrition and child under- and overnutrition coexist. The combined anthropometric and IYCF practices profile points to poor nutrition during the first 1000 days of life of infants and young children from these communities.

Valuable experience was gained working with the IYCF indicators at service delivery level. It is recommended that the National and Provincial Nutrition Directorates in collaboration with other government departments strengthen the use of at least some of the core set of WHO IYCF indicators in the DHIS community-based research projects, as well as larger-scale population studies in SA.

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