

# Early infant feeding practices of mothers attending a postnatal clinic in Ga-Rankuwa



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**Background.** Despite the recommendation of the World Health Organization (WHO) of exclusive breastfeeding for the first 4 - 6 months of life, several South African studies on infant feeding practices have shown that the introduction of feeds other than breastmilk before 4 months is a common practice. The timing of initiation of complementary feeding within the first 4 months is, however, difficult to determine.

**Objective.** To determine feeding practices of mothers of infants 8 weeks of age or younger, attending the postnatal clinic at Ga-Rankuwa Hospital.

**Methods.** A cross-sectional study of mothers attending the postnatal clinic at Ga-Rankuwa Hospital using a standardised interview schedule.

**Results.** A total of 150 mothers were interviewed. All infants in the sample were younger than 9 weeks of age. The mean age of the sample was 37.4 (5.2 weeks)  $\pm$  12.1 days. Although 99% of infants were breastfed, exclusive breastfeeding was practised by only 4.6% of the sample. Water was given to 88%, infant formula to 43% and complementary feeds to 37%. Forty-six per cent of mothers said that the reason for giving water to their babies was to prevent constipation. Infant formula was added because mothers believed that their breastmilk was insufficient for their infants' needs. Of the complemented infants, 91% had received complementary feeds before 7 weeks of age. Thin maize meal porridge providing less than 1 kJ/ml and negligible protein was the most commonly given first food.

**Conclusion.** Breastfeeding was almost universal, exclusive breastfeeding was the exception. Mixed feeding was common, with the introduction of complementary feeds occurring within the first 2 months of life, well before the WHO recommendations.

In 2001, the World Health Organization (WHO)<sup>1</sup> revised its earlier recommendation of exclusive breastfeeding of infants for 4 - 6 months of age<sup>2</sup> to exclusive breastfeeding until 'about 6 months' of age with complementary feeds added thereafter. This recommendation confirmed that breastmilk alone is sufficient to meet the infant's nutritional requirements for the first 6 months of life.<sup>1</sup> In practice, however, foods other than breastmilk are frequently fed to younger infants, sometimes being introduced within the first month of life.<sup>3</sup> The extent of the practice of early complementary feeding is difficult to establish from the literature. Many studies on early infant feeding practices either categorise the age of complementary feed introduction relatively broadly, for example as younger than 2 months,<sup>4,7</sup> 2 - 3 months<sup>8,9</sup> and 3 or 4

months,<sup>10</sup> or focus on complementary feeding of infants older than 4 months,<sup>11-15</sup> thus losing important information on the actual timing of complementary feed initiation.

Complementary feeding of very young infants holds several possible risks. Physically and physiologically the young infant is not ready to handle non-milk foods. The still strong oral suckle swallow and extrusion reflexes and immature tongue movements interfere with swallowing.<sup>16</sup> There is evidence that early complementing of breastfed infants reduces the intake of breastmilk and shortens the total duration of breastfeeding.<sup>17</sup> Complementary feeding introduces a source of contamination through feeding utensils and feeds while the infant's immune system is immature

and dependent on the protective factors in breastmilk, increasing the risks of diarrhoea and other infectious diseases,<sup>18</sup> and undernutrition has been associated with early complementary feeding.<sup>19</sup>

In light of the common practice of early complementary feeding and the possible negative effects on the infant's health, it is important that accurate information about the timing and practice of complementary feeding be obtained. This study was undertaken to document the types, amounts and nutritional value of complementary foods given and the timing of complementary feeding during the first 8 weeks of life.

## Methods

### Sample

A sample of convenience of mothers attending the postnatal clinic at Ga-Rankuwa Hospital, situated on the border of the Gauteng and North-West provinces, was taken during October and November 1997 and from April to August 1998. The clinic provided the routine postnatal check-up (between 4 and 8 weeks postpartum) for mothers of healthy babies delivered at Ga-Rankuwa Hospital. High-risk infants, such as premature and low-birth-weight infants, attended a separate clinic. Mothers present at the start of the clinic and who indicated willingness to participate in the study were interviewed.

### Data collection

Mothers were interviewed by 3 trained interviewers using a structured interview schedule. Questions were asked regarding feeding method and frequency, water use, infant formula use and preparation and complementary feeds. Feeding bottles and cups were used to assist the estimation of volumes and amounts of feeds given. Completed interview schedules were cross-checked for completeness by one of the researchers.

### Data analysis

Data were coded and cross-checked by two of the authors. Computer data entry was checked by duplicate data entry. Data analysis was by the EpiInfo2000 programme.<sup>20</sup> For the purpose of this study, the WHO definition of exclusive breastfeeding, that is 'no other liquids or solids than breastmilk, not even water given to an infant',<sup>2</sup> was used. Data on complementary feeds were coded and household measures converted to weights using standard conversion tables.<sup>21</sup> Nutrient analyses were done using the FoodFinder3 dietary analysis software.<sup>22</sup>

### Ethics

The project was approved by the Research, Ethics and Publications Committee of the Faculty of Medicine of the Medical University of Southern Africa. All

participants were fully informed about the study and gave written consent. When appropriate, the interviewers counselled mothers on infant feeding after the interviews had been completed.

## Results

### Sample description

The sample comprised 150 mother-infant pairs (65 females and 85 males) with a mean infant age of  $37.4 \pm 12.1$  days and range of 6 - 61 days.

### Breastfeeding

Table I summarises the frequency and combinations of feeding methods according to infant gender and Table II the type of feeds given according to age. All except 1 infant were breastfed. Only 7 infants (4.6%), however, were exclusively breastfed. The remainder were given water, formula, complementary feeds or a combination of these in addition to breastmilk (Table I). The exclusively breastfed infants were significantly younger (mean age =  $28.6 \pm 15.4$  days) than the non-exclusively breastfed infants (mean age  $37.9 \pm 11.8$  days) ( $p = 0.046$ ).

### Water use

Altogether 132 (88%) of the infants received water. For 48 (36%) of these, water was the only feed given in addition to breastmilk (Table I). There appeared to be no association between the giving of water and the gender of the infant ( $p > 0.05$ ) (Table I). There was also no significant difference between the mean ages of infants receiving water ( $37.6 \pm 11.8$  days) and those not receiving water ( $36.7 \pm 14.6$  days) ( $p = 0.77$ ).

Of the mothers giving water, only 1 did not boil the water before giving it to her infant. Mothers gave the water by bottle (73%), teaspoon (23%) or bottle cap (4%). The amount of water given at a time varied from 5 ml to 125 ml with a mean intake of  $49.5 \pm 52.6$  ml. The majority of mothers (65%) gave water 2 - 3 times per day, 19% gave water once a day while 16% gave water more than 3 times per day. Sugar, gripe water and salt were added to the water by 64 (48%), 35 (26.5%) and 12 (9%) mothers respectively. The reasons for giving water are given in Table III. Other reasons given by 1 mother each included preventing diarrhoea, because her nipples were painful, to help 'make blood' and because she was working.

### Infant formula use

Infant formulas were given to 43% (64) of the infants, with all except 1 of these infants receiving the formula in addition to breastmilk only (10; 16%), breastmilk and water (29; 45%) or breastmilk, water and one or more types of complementary feeds (24; 38%) (Table I). Use of formula feeds among males and females was similar ( $p > 0.05$ ). No mothers had given infant formula during

Table I. Frequency of types of feeds given according to gender (N = 150)							
Type of feed	Total		Male		Female		p*
	N	%	N	%	N	%	
Breastmilk alone	7	4.7	3	3.5	4	6.2	0.574
Breastmilk + water	48	32.0	22	25.9	26	40	0.070
Breastmilk + formula	10	6.7	5	5.9	5	7.6	0.632
Breastmilk + CF	2	1.3	1	1.2	1	1.5	0.8
Breastmilk, water + CF	29	19.3	21	24.7	8	12.3	0.056
Breastmilk, water + formula	29	19.3	17	20	12	18.5	0.785
Breastmilk, water, formula + CF	24	16.0	15	17.6	9	13.8	0.529
Formula, water, CF	1	0.6	1	1.2	0	0	1.0
Total	150	100	85	100	65	100	
Summary of types of feeds							
Breastfed	149	99.3	84	98.8	65	100	1.0
Water	132	88.0	77	90.6	55	84.6	0.265
Formula	64	42.7	38	44.7	26	40.0	0.563
Complementary feeds	56	37.3	38	44.7	18	27.7	0.033

\*p-value for chi-square test.  
CF = complementary feeding.

Table II. Frequency of use of water, infant formulae and complementary feeds according to age (N = 150)									
Age (days)	N	Exclusively breastfed		Water		Infant formula		Complementary feeds	
		N	%	N	%	N	%	N	%
< 7	7	2	28.5	5	71.4	0	0	0	0
7 - 13	4	0	0	3	75.0	3	75.0	1	25.0
14 - 20	7	0	0	6	85.7	4	57.1	2	28.6
21 - 27	7	0	0	6	85.7	4	57.1	1	14.3
28 - 34	15	2	13.3	13	86.7	5	33.3	4	26.7
35 - 41	45	3	6.7	41	91.1	22	48.9	22	48.9
42 - 48	52	0	0	47	90.4	19	36.5	21	40.4
≥ 49	13	0	0	11	84.6	7	53.8	5	38.5
Total	150	7	4.7	132	88.0	64	42.7	56	37.3

Table III. Reasons for giving water (N = 132)		
Reason	N	%
To prevent constipation/ to loosen the stools	60	45.5
To quench thirst	35	26.5
Was told to give water	14	10.0
To relieve stomach cramps	8	6.1
To prevent dehydration with diarrhoea	3	2.2
To cleanse the bladder	2	1.5
No reason given	7	5.3
Other	4	3.0

the first week of life. Of the infants aged between 7 and 28 days, 61% (11) received formula feeds, while 42% (53) of those older than 28 days received formula

feeds (Table II). This difference, however, was not significant ( $p = 0.13$ ).

Mothers who gave formula feeds were asked to describe how they mixed the formula. The correct amount of formula powder to water (4 scoops per 100 ml water) was used by 51 (82%) of the mothers. Feeds were made too dilute (less than 4 scoops per 100 ml water) by 7 mothers and too concentrated by 4 mothers (5, 6 or 7 scoops per 100 ml water). The volume of formula given per feed varied from 25 ml (1 mother) to 250 ml (2 mothers), with 16 (25%), 14 (22%) and 12 (19%) giving 50, 75 and 100 ml per feed, respectively. Over half of the mothers (59%) who gave formula feeds did so 1 - 3 times per day, 7 mothers gave formula feeds on demand, 5 alternating with breastfeeds and the remainder more than 3 times per day. The reasons given for the introduction of formula feeds are summarised in Table IV.

<b>Table IV. Reasons for giving infant formula (N = 64)</b>		
<b>Reason</b>	<b>N</b>	<b>%</b>
Breastmilk is not enough	30	46.9
Mother has to go to work/school	16	25.0
To mix with porridge/cereal	7	10.9
The mother's choice	4	6.3
Good for the baby	2	3.2
Flat nipples	2	3.2
Advised to give formula	1	1.6
Mother is sick	1	1.6
Do not know	1	1.6

### Complementary feeds

Complementary feeds had been introduced to 56 (37%) of the infants, the majority either in combination with water (29; 52%) or with water and formula feeds (24; 43%) (Table I). The mean age ( $40.6 \pm 8.7$  days) of infants receiving complementary feeds was significantly older than that of those not yet introduced to complementary feeds ( $35.6 \pm 13.4$  days) ( $p = 0.02$ ). By 5 weeks of age, 5% (8) of all infants had been introduced to complementary feeds, while by 7 weeks of age 34% (51) of all infants were given complementary feeds (Table II). Although a significantly higher proportion of males (45%) than females (28%) received complementary feeds ( $p = 0.033$ ), multiple linear regression using age and gender as the independent variables and complementary feeding as the dependent variable showed that only age was significantly associated with complementary feeding ( $p = 0.044$ ).

The breakdown of the types, feeding methods and number of feeds per day of complementary feeds is given in Table V. Although only half of the mothers provided sufficient information to allow for nutrient analysis of the feeds, the energy and protein contents of the feeds were estimated. Thin, gruel-like porridge made from maize meal and water with an estimated proportion of 6 - 12 g (1 - 2 tablespoons) maize meal to 250 ml water, was the most frequently used complementary food. Eight infants were fed the gruel by bottle, requiring the thinner dilution. A mean intake

of thin porridge of  $35 \pm 26$  g per feed provided less than 30 kJ (1 kJ/ml) and negligible protein per feed. The nutritional value of the maize meal porridge of 7 infants was improved by the addition of formula milk powder, 1 scoop providing an additional 85 kJ and 0.5 g of protein.

Commercial infant cereal was fed to 18 (32%) of the complemented infants. For 17 the cereal was mixed with formula milk powder or whole milk powder (1 infant). An estimated mean intake of  $16 (\pm 9)$  g of infant cereal mixed with formula milk provided approximately 200 kJ and 1.2 g protein. The number of complementary feeds given per day varied between 2 and 6 and did not differ among types of feeds ( $p > 0.05$ ).

### Combinations of feeds

Table I shows that 56% of the mothers gave their infants more than one type of feed in addition to breastmilk. Water was common to all combinations of more than two feeds. Complementary feeds or infant formulae were given in combination with breastmilk and water by an equal number of mothers (29), while 24 (16%) fed their infants four different types of feed: breastmilk, water, infant formula and complementary feeds.

### Discussion

The finding that breastfeeding was virtually universal (99.3%) among our study sample confirm that it is not the failure to breastfeed, but rather the failure to exclusively breastfeed and the feeds given in addition to breastmilk, that are causes for concern. Similarly high breastfeeding initiation rates have been reported by most South African studies on early infant feeding practices,<sup>7,8,19,23-25</sup> with a national average of 86%.<sup>26</sup> Reports on the duration of exclusive breastfeeding, however, appear conflicting, possibly due to differences in the definition of exclusive breastfeeding. Using the WHO definition of exclusive breastfeeding,<sup>2</sup> less than 5% of infants were exclusively breastfed in the present study. Moeng<sup>27</sup> reported from a longitudinal infant feeding study conducted in Soshanguve, that only 1.7% of 307 infants were exclusively breastfed between 1 and

<b>Table V. Frequency of types of complementary feeds given, feeding method and mean (standard deviation) number of feeds given per day (N = 56)</b>				
<b>Type of feed</b>	<b>N (%)</b>	<b>Feeding method</b>		<b>Number of feeds per day (mean (SD))</b>
		<b>Spoon</b>	<b>Bottle</b>	
		<b>N (%)*</b>	<b>N (%)*</b>	
Thin maize meal porridge <sup>†</sup>	35 (60.7)	27 (77)	8 (23)	4.3 (1.0)
Infant cereal	18 (32.1)	15 (83)	3 (17)	4.7 (1.5)
Commercial first food	4 (7.1)	4 (100)	0	4.5 (1.3)

\*Per cent of number of infants receiving type of feed.  
<sup>†</sup>6 - 12 g maize meal to 250 ml water.

2 months of age, and almost 70% were given water. Likewise, Faber and Benade<sup>7</sup> found that over 60% of mothers gave their infants water within the first month of life. By contrast, Delpont *et al.*<sup>24</sup> from a similar area to our study, reported that 92% of 106 infants were exclusively breastfed at 1 month but did not mention the giving of water or herbal mixtures, a common practice reported by other studies.<sup>7,27-29</sup> Many mothers in our study initially gave the impression of exclusive breastfeeding. It was only after specifically asking about water that its use became apparent. Engle<sup>30</sup> reported a similar situation in India with the explanation that, as giving water is considered a normal part of infant feeding, mothers tend not to mention water unless specifically asked. It is therefore likely that studies which do not probe for the feeding of water to young infants may over-report exclusive breastfeeding rates.

The use of infant formulae by 43% of the sample is lower than the reported incidences of formula feeding in urban areas<sup>27,31</sup> but higher than those of rural areas.<sup>7,9</sup> A study on the impact of urbanisation on the health of preschool children in Transkei<sup>23</sup> showed a higher incidence of formula feeding at 1 month among urban infants (65%) than among peri-urban (55%) and rural infants (51%). This might be a reflection of the greater availability and affordability of infant formulae in the urban areas and the need for mothers to return to work, as indicated by 28% of mothers in our study. Mothers seemed to believe that their breastmilk alone was inadequate for their infants' needs. This belief appears to be very common in other areas of South Africa and Africa.<sup>9,25,27,31,32</sup>

Major concerns of formula feeding are hygiene and the use of feeds which are either too dilute, with the associated risks of undernutrition, or too concentrated, possibly resulting in hypernatraemic dehydration and overweight.<sup>33</sup> Regarding hygiene, it was gratifying that all but 1 of the carers used boiled water for formula preparation. Nevertheless, the risk of contamination of the prepared formula feed cannot be ignored.<sup>16</sup> Most mothers used the correct concentration of feed, with only 4 mothers using a feed which was too concentrated and 7 preparing feeds with less than the required concentration of formula powder. This finding was in contrast to the finding of Kruger and Gericke<sup>9</sup> that 30% of mothers gave formula feeds which were too dilute and 15% feeds that were too concentrated, but confirms that there is a greater tendency to over-dilute than to under-dilute formula feeds.

The introduction of complementary foods within the first 2 months by approximately one-third of the mothers is similar to some but higher than other reported proportions of early complementary feeding in South Africa. Comparisons among studies are difficult due to methodological and age categorisation differences. While some cross-sectional studies relying

on the mother's recall show low incidences of early complementary feeding (e.g. Ruhle<sup>25</sup> and Faber and Benade<sup>7</sup> reported that 11.3% and 4% of mothers introduced complementary feeding before 2 months, respectively) others such as that of Kruger and Gericke,<sup>9</sup> using a qualitative focus group approach, found that 87% of infants were complementary fed by 3 months. Steyn *et al.*<sup>19</sup> also using a recall method, but in a rural area, reported 40% of normal weight and 33% of underweight infants receiving supplementary feeds by 2 months. It is not clear, however, whether 'supplementary' feeding referred to the addition of infant formula or other foods.

Similar disagreement exists for prospective studies. Moeng<sup>27</sup> found at follow-up of infants aged between 1 and 2 months, that 56%, 24% and 8% of infants were receiving soft porridge, commercial cereals or other solid foods, respectively. Our finding that 16% of infants younger than 1 month received complementary feeds is lower than that of a Malawian longitudinal study which found that 30% of infants had been given complementary porridges by 1 month.<sup>34</sup> By contrast, Delpont *et al.*<sup>24</sup> found that only 7% of infants were given soft maize meal porridge in the first month but 69% received complementary feeds by 3 months.

Our results suggest that complementary feeding is most frequently initiated when an infant is between 4 and 8 weeks of age (Table II). This appears to be younger than the peak incidence of complementary feed initiation of between 2 and 3 months reported in other South African studies.<sup>7,9,24,25</sup>

The use of a cereal-based gruel is a common feature of infant feeding in African countries.<sup>32,35,36</sup> As in other South African studies,<sup>7-9,19,24,25,27</sup> thin maize meal porridge was the most commonly given first complementary food. Our estimation that the maize meal porridge provided approximately 1 kJ/g agrees with those of Michaelson *et al.*<sup>16</sup> and Hotz and Gibson;<sup>15</sup> this is less than half the energy provided by breastmilk (2.8 kJ/g).<sup>22</sup> Cohen *et al.*<sup>11</sup> and Heinig *et al.*<sup>37</sup> have demonstrated that infants older than 4 months self-regulate their energy intakes by decreasing breastmilk consumption when complementary feeds are added. Thus, the early introduction of complementary feeds, rather than increasing, may reduce the infant's energy and nutrient intakes.<sup>38</sup> Over half the infants received various combinations of feeds which could interfere with breastmilk intake and, together with an increased risk of infection through contaminated utensils and feeds and reduced intake of protective factors from breastmilk,<sup>18</sup> could set up the familiar cycle of under-nutrition and infection.

The generalisability of our results is limited by the fact that our sample was hospital based, and thus not representative of infant feeding practices in the community. The study by Moeng<sup>27</sup> which was

conducted in Soshanguve, the main catchment community of Ga-Rankuwa Hospital at approximately the same time (1997 - 1999) and in the same age group as our study, showed a lower incidence of exclusive breastfeeding (1.7% v. 4.7%) and a higher incidence of complementary feeding (at least 56% v. 37%). It is therefore possible that our results reflect a slightly better picture of early infant feeding practices than is the case in the community setting.

## Conclusion

While our study confirmed that breastfeeding was practised almost universally among the study population, it also showed that the addition of feeds other than breast milk within the first 1 - 2 months of the infant's life was common. Contrary to the WHO recommendations<sup>1,2</sup> and to the findings of other studies<sup>7,9,24,25</sup> that complementary feeding is initiated most frequently during the third month, our results suggest that complementary feeding was initiated earlier, usually during the second month. Additionally, it is clear that frequently more than one type of feed is added to the infant's diet. The displacement of breastmilk by nutritionally inadequate complementary feeds and the potential damage to the immature gastrointestinal tract at this age hold serious consequences for the growth and health of the infant.

- World Health Organization. Report of the expert consultation on the optimal duration of exclusive breastfeeding. Geneva, Switzerland 28-30 March, 2001. WHO/NHD/01.09/WHO/FCH/CAH/01.24. Available from: [http://www.int/nut/documents/optimal\\_duration\\_of\\_exc\\_bfeeding\\_report.en.g.pdf](http://www.int/nut/documents/optimal_duration_of_exc_bfeeding_report.en.g.pdf). (Last accessed 15 March 2004).
- World Health Organization. The World Health Organization's infant-feeding recommendation. *Weekly Epidemiological Record* 1995; **70**: 119-120.
- Gibson RS, Hotz C, Lehrfeld J, Ferguson EL. Nutrient content, density and bioavailability of complementary foods in Sub-Saharan Africa. In: Fitzpatrick DW, Anderson JE, L'Abbe ML, eds. *From Nutritional Science to Nutrition Practice for Better Global Health*. Proceedings of the 16th International Congress of Nutrition. Ottawa, Canada: Canadian Federation of Biological Societies, 1998:99-101.
- Forsythe JS, Ogston SA, Clarke A, du V Florey C, Howie PW. Relation between early introduction of solid food to infants and their weight and illnesses during the first two years of life. *BMJ* 1993; **306**: 1572-1576.
- Simondon KB, Simondon F. Age at introduction of complementary food and physical growth from 2 to 9 months in rural Senegal. *Eur J Clin Nutr* 1997; **51**: 703-707.
- Savage S-AH, Reilly JJ, Edwards CA, Durnin JVGA. Weaning practices in the Glasgow longitudinal infant growth study. *Arch Dis Child* 1998; **79**: 153-156.
- Faber M, Benade AJS. Nutritional status and dietary practices of 4-24-month-old children from a rural South African community. *Public Health Nutrition* 1999; **2**: 179-185.
- Zollner E, Carlier ND. Breast-feeding and weaning practices in Venda, 1990. *S Afr Med J* 1993; **83**: 580-583.
- Kruger R, Gericke GJ. A qualitative exploration of rural feeding and weaning practices, knowledge and attitudes on nutrition. *Public Health Nutrition* 2003; **6**: 217-223.
- Hediger ML, Overpeck MD, Ruan WJ, Troendle JF. Early infant feeding and growth status of US-born infants and children aged 4-7 mo: from the third National Health and Nutrition Examination Survey, 1988-1994. *Am J Clin Nutr* 2000; **72**: 159-167.
- Cohen RJ, Brown KH, Canhuati J, Rivera LL, Dewey KG. Effect of age of introduction of complementary foods on infant breast milk intake, total energy intake, and growth: a randomised intervention study in Honduras. *Lancet* 1994; **343**: 288-293.
- Dewey KG. Optimal duration of exclusive breast-feeding. In: Fitzpatrick DW, Anderson JE, L'Abbe ML, eds. *From Nutritional Science to Nutrition Practice for Better Global Health*. Proceedings of the 16th International Congress of Nutrition. Ottawa, Canada: Canadian Federation of Biological Societies, 1998: 45-47.
- Nielsen GA, Thomsen GL, Michaelsen KF. Influence of breastfeeding and complementary food on growth between 5 and 10 months. *Acta Paediatr* 1998; **87**: 911-917.
- Hautvast JLA, van der Heijden LJM, Luneta AK, van Staveren WA, Tolboom JJM, van Gastel SM. Food consumption of young stunted and non-stunted children in rural Zambia. *Eur J Clin Nutr* 1999; **53**: 50-59.
- Hotz C, Gibson RS. Complementary feeding practices and dietary intakes from complementary foods amongst weanlings in rural Malawi. *Eur J Clin Nutr* 2001; **55**: 841-849.
- Michaelsen KF, Friis H. Complementary feeding: a global perspective. *Nutrition* 1998; **14**: 763-766.
- Rogers IS, Emmett PM, Golding J. The incidence and duration of breast feeding. *Early Human Development* 1997; **49** (suppl): S45-S74.
- Golding J, Emmett PM, Rogers IS. Gastroenteritis, diarrhoea and breast feeding. *Early Human Development* 1997; **49** (Suppl): S83-S103.
- Steyn NP, Nel JH, Kunneke E, Tichelaar HY, Oelofse A, Prinsloo JF, Benade AJS. Differences between underweight and normal weight rural preschool children in terms of infant feeding practices and socio-economic factors *S Afr Med J* 1998; **88**: 641-646.
- Dean AG, Garner TG, Sangam S, et al. *Epi Info 2000. A database, and statistics program for public health professionals*. Centers for Disease Control and Prevention, Atlanta, Georgia: 2000.
- Langenhoven ML, Conrad PJ, Wolmarans P, Faber M. *Food Quantities Manual*. 2nd ed. Parow: South African Medical Research Council, 1991.
- Medical Research Council, South Africa. *FoodFinder 3 Dietary Analysis Program*. Parowvallei: Medical Research Council, 2003.
- Byarugaba J. The impact of urbanisation on the health of black pre-school children in the Umtata district, Transkei, 1990. *S Afr Med J* 1991; **79**: 444-448.
- Delport SD, Becker PJ, Bergh A. Growth, feeding practices and infections in black infants. *S Afr Med J* 1997; **87**: 57-61.
- Ruhle MM. Breast-feeding and weaning practices and attitudes of mothers and/or childminders of under 2-year-old children, Soshanguve. MSc (Dietetics) thesis. Medical University of Southern Africa, 1999.
- MacIntyre U, Labadarios D. Dietary intake: quantitative food frequency method. In: Labadarios D, Steyn N, Maunder E, et al., eds. *The National Food Consumption Survey (NFCS): Children aged 1 - 9 years, South Africa 1999*. Unpublished report. Pretoria: Department of Health, 2000.
- Moeng TL. Lactation practices of mothers in Soshanguve. MSc (Dietetics) thesis. Medical University of Southern Africa, 2003.
- Nwankwo BO, Brieger W. Exclusive breastfeeding is undermined by use of other liquids in rural Southwestern Nigeria. *J Trop Pediatr* 2002; **48**: 109-112.
- Potur AH, Kalmaz N. An investigation into feeding errors of 0-4-month old infants. *J Trop Pediatr* 1996; **42**: 173-175.
- Engle PL. Infant feeding styles: barriers and opportunities for good nutrition in India. *Nutrition Reviews* 2002; **60**: S109-S114.
- Hoffman MN, Durcan NM, Disler PG. Breast-feeding in a socio-economically disadvantaged area of Cape Town. *S Afr Med J* 1984; **66**: 64-65.
- Harrison GG, Zaghloul SS, Galal OM, Gabr A. Breastfeeding and weaning in a poor neighbourhood in Cairo, Egypt: maternal beliefs and perceptions. *Soc Sci Med* 1993; **36**: 1063-1069.
- Egemen A, Kusin N, Aksit S, Emek M, Kuugol Z. A generally neglected threat in infant nutrition: incorrect preparation of infant formulae. *Turk J Pediatr* 2002; **44**: 298-303.
- Vaahtera M, Kulmala T, Hietanen A, et al. Breastfeeding and complementary feeding practices in rural Malawi. *Acta Paediatr* 2001; **90**: 328-332.
- Mabila M. Beliefs and practices in infant feeding among the Wagogo of Chigongwe (Dodoma rural district) Tanzania II Weaning. *Ecology of Food and Nutrition* 1996; **35**: 209-217.
- Kwaku EA, Omwega AM, Muroki NM, Mwadime RKN. Evaluation of weaning diets in peri-urban Kumasi, Ghana. *East Afr Med J* 1998; **75**: 142-147.
- Heinig MJ, Nommsen LA, Peerson JM, Lonnerdal B, Dewey KG. Intake and growth of breast-fed and formula-fed infants in relation to the timing of introduction of complementary foods: the DARLING study. *Acta Paediatr* 1993; **82**: 999-1006.
- Dewey KG. Cross-cultural patterns of growth and nutritional status of breast-fed infants. *Am J Clin Nutr* 1998; **67**: 10-17.