pregnancies, malaria and some medical conditions, are all factors increasing the risk of delivering a low-birth-weight baby.[22] Eleven per cent of newborns (12.5 million infants) are low birth weight at term.[23] In Africa, 8.9% of children have a low birth weight.[24] In South Africa, low birth weight has been related to lower social class, occupation of the breadwinner, increased occupational density and poorer family stability.[16] In an informal settlement area in Khayelitsha low-birth-weight children had a 3 times greater risk of being underweight for age and twice the risk of being stunted than children with birth weights higher than 2.5 kg.[25] It can therefore be concluded from the NutriGro data that the low-birth-weight infants had a higher chance of being stunted.

In the NutriGro Study more mothers (36%) than fathers (30%) were the head of the household. Posel[26] confirmed that the risk of poverty is higher in households headed by women than households with a male head. Despite the lower income levels in female-headed households, food security and the nutritional status of the children were higher than in households headed by men, suggesting that more income was spent on the nutritional needs of household members.[26]

Household size in the NutriGro study was similar to the average documented in other South African studies.[3,27] Higher stunting rates were documented in larger households in the NutriGro Study (Table II). Similar to a Mozambican study,[28] larger household size appeared to affect the nutritional status of children negatively.

Economic wealth and the associated influx of people searching for jobs in urban areas of South Africa, coupled with the migrant labour system have led to the widespread practice of children being left in the care of relatives in rural areas.[29] In rural areas the non-stunted children (65%) were more often looked after by mothers than the stunted children (39%). In the urban areas the mother was primarily the main caregiver because of unemployment, whereas rural mothers had to leave their children with other caregivers in order to work in urban areas. Other caregivers, normally grandmothers, took care of the children in the rural areas. This could have influenced the nutritional status of the children negatively because these caregivers could not perform certain maternal functions such as breastfeeding. However the issue is more complex as more stunted children in the rural areas were breastfed for longer than in the urban areas.

The percentage of obesity among M/Cs (26%) documented in the NutriGro Study was high compared with other countries and World Health Organization (WHO) standards,[13] but comparable to other South African studies.[30,31] In the NutriGro Study a high percentage of stunted children had either an overweight (21%) or obese mother (22%). The issue of an obese M/C with a stunted child was also documented during another study in the Limpopo Province.[32] The contradiction between overweight M/Cs and stunted children could be the result of an inadequate distribution of food in the household.[33]

The NutriGro Study found that in both areas 74% of the M/Cs breastfed their children for 13 months or more. These results were higher than the national average of 63% and 62% recorded by the NFCS[3] and the SAVACG[4] studies respectively.

Early introduction of water and complementary food as documented in the NutriGro Study is common, as has been reported by other researchers.[34,35] The early introduction of complementary feeds puts the infant at increased risk of both undernutrition and infection. Early introduction of complementary food has been shown to interfere with breastmilk intake and to reduce energy and nutrient intakes.[36] At the same time, the infant's still-immature immune system is exposed to an increased risk of infection through contaminated feeds, setting the undernutrition-infection cycle in motion.[37]

Conclusions and implications for future research

It is clear from the NutriGro Study that the causes of stunting in the rural and urban areas were multifactorial and complex. While other South African studies have shown higher prevalences of stunting in rural than urban areas, the NutriGro Study has shown that when both communities were poor, the rates of stunting were similar, if not higher, in the urban communities. In addition, our study showed that low birth weight, early complementary feeding and large household size impacted negatively on stunting.

As pointed out, the results reported here are those of the first phase of a multi-phase study. In an attempt to further unravel the complex causes of stunting, data were collected on food security,[38] dietary intake[39, 40] and care practices[41,42] from households with and without stunted children, in phase 2 of the study.

To address the problems identified during the NutriGro Study it is clear that well-planned multidisciplinary intervention programmes should include education strategies aimed at improving the knowledge of mothers, caregivers and grandparents on nutrition promotion, including healthy feeding practices. Factors affecting the health and nutrition of children, mothers and pregnant women must also be addressed in intervention programmes.

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