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Can home garden produce have an impact on the nutritional status of pre-schoolers?

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Abstract

Aim of the study: This study set out to determine the impact of home gardens on the nutritional status of pre-school children in an informal settlement in South Africa.

Methods: Children aged two to five years (n=40) were selected to participate in the study. The sampled children were divided into groups: 24-35 months (four boys and one girl), 36-47 months (four boys and five girls) and 48-60 months (14 boys and 12 girls).The children's anthropometric measurements were taken and recorded

Summary of Results: Twenty-five percent of boys (24-35 months) were underweight and below the 50th percentile at the pre- and post-project stages. Of the boys aged 36-47 months, 25 per cent were stunted pre-project and had decreased to 50 per cent. Twenty-one percent of the older boys (48-60 months) were within their normal height for age. Twenty-five percent of girls were underweight (36-47 months). All girls aged 24-35 months were below -2 standard deviations pre-project and were severely stunted post-project. The older girls were well nourished with means of height-for-age at -0.88 (below 50th percentile) pre-project and -0.92 (below 50th percentile) post-project.

Conclusions: The results highlight that malnutrition is problematic among children all age groups in this sample. Home gardens had
no statistically significant impact on anthropometric measurements of the children. A concerning, negative statistical difference was found between pre- and post-study height-for-age z-scores for boys, showing significant deterioration of nutritional status among boys.

Key words: home gardens, nutritional status, preschool children, z-scores, stunting

INTRODUCTION AND BACKGROUND

During the first five years of life, children develop the physical, social and mental capabilities necessary for a productive future. As children are still growing and developing, their nutrient needs, are relatively higher than adult requirements (FAO, 1998; Napier, 2006; Glyn et al., 2005). The quality of a child's diet is a key determinant of optimal growth, development and health. Thus poor nutrition not only retards growth and development but also reduces opportunities for a productive life and increases children's risk of developing chronic diseases such as obesity, increased cholesterol levels and hypertension later in life (Boulton, 1995; Berenso et al., 1998; Skinner et al., 2004). The World Health Organisation (WHO, 1999) has identified that poor growth results from nutritional deficiencies in energy and protein, as well as iodine, iron, zinc and vitamin A.

Dietary diversification is, therefore, widely promoted as an affordable strategy to improve nutrition for the majority of the population - particularly the poor. Onyango (2003), Hatloy et al. (2000) and Onyango et al. (1998) investigated links between food variety, improved health and nutritional status and showed that improved intakes of fruit and vegetables improve the intakes of minerals and vitamins. Therefore, Bolaane (2006) reported that dietary diversity must be promoted to help increase energy and nutrients intake.

Micronutrient deficiencies may be addressed by increasing the availability of, access to, and ultimately consumption of foods that are rich sources of micronutrients. Home gardening could reduce micronutrient deficiencies by providing nutrient rich foods (FAO, 2002). Home gardening can provide households with direct access to sustainable food supplies that can be harvested, prepared and consumed daily by household members. Indeed, one of the recommendations of the the NFCS (Labadarios *et al*., 2000) was that food production at household level must be advocated and the contribution that home gardens can make to children's diet should be recognised and appreciated. Moreover, Tonstisirin *et al.* (2002) have stated that strategies that promote household production are sustainable interventions as such gardens are sustainable, reducing the need for long-term external financial support.

Malnutrition is a concern across the world. Poverty, household food insecurity and malnutrition are common causes of death among children in Africa. Malnutrition is both a cause and a consequence of poverty. Sound and adequate nutrition is a pre-condition for human and economic development. Malnutrition constrains this by increasing vulnerability to illness, increasing mortality and reducing labour productivity (Napier, 2006). Malnutrition may lead to death, increased health costs, decreased mental capacity and it lowers future productivity.

Malnutrition is also a concern in South Africa, where child malnutrition is still unacceptably high. There is considerable focus on home gardens globally and, in South Africa, with numerous governmental, non-governmental and community projects promoting home gardens to improve nutrition and food security (Selepe, 2010). However, very little empirical and no comprehensive evidence exists to show that home gardens do, in fact, have a significant, positive impact on children's nutrition. Often home garden projects are not set up in ways that do not enable pre/post empirical testing of the impact on beneficiary nutritional status (Selepe, 2010).

Urban agriculture is a strategy widely promoted for poor urban, informal settlement residents to reduce poverty and improve food security and child nutrition (Rothwell, 1994). It is widely asserted in literature and development circles that household vegetable gardens can provide a significant percentage of recommended dietary allowances of macro- and micro-nutrients in the diets of pre-school children. These children are vulnerable in terms of food access and nutrition (Rothwell, 1994). The early years of a child's life are crucial to her/his physiological and psychological well-being. Therefore, good nutrition in sound socio-economic environment is the foundation of health and well-being of a child's life (Flyman and Afolayan, 2006). Malnutrition increases vulnerability to infections, which can result in death. Malnutrition has social and economic impacts and affects cognitive development, reduces resources and lowers the earning capacity of households (Flyman and Afolayan, 2006). Approximately 40 minerals and vitamins are considered essential for mental and physical growth, healthy immune systems and sound metabolic processes (Vitamin Information Centre (VIC, 2001). An improvement in nutrition will lead to improved health status, well-being and development opportunities.

The South African Vitamin A Consultative Group (SAVACG) was the first national nutrition study (conducted in 1994) looking at the anthropometric profile of pre-school children (Labadarios and van Middelkop, 1995). The study reported that 24 per cent of South African children were stunted and nine per cent were underweight. The SAVACG study reported a 21.4 per cent prevalence of anaemia, 10 per cent prevalence of iron deficiency, a five per cent prevalence of iron deficiency anaemia, and that one in three pre-school children presents serum retinal concentrations below 20µg/dl which indicate vitamin A deficiency (VAD). The Eastern Cape had the highest levels of malnutrition. Vitamin A deficiency (VAD) and anaemia were observed in one third and 20 per cent of all sampled children respectively (Labadarios, 1999). The most disadvantaged children are those aged 12 to 71 months, who live in informal settlements and whose mothers are mostly uneducated.

The National Food Consumption Survey (NFCS) was conducted in 1999 to determine the nutritional status of children aged 1-9 years (Labadarios et al., 2000). This survey showed that the majority of the children appeared to consume a diet low in energy, poor in protein quality and low in micronutrient density. Only one out of four households appeared to be food secure. Half the children aged 12 to 108 months consumed less than half the recommended intakes for vitamin A, vitamin C, riboflavin, niacin, vitamin B_6, folate, calcium, iron and zinc. Iron deficiency anaemia was a common problem among the children in rural communities (Labadarios et al., 2000).

This study set out to conduct an in-depth and comprehensive empirical analysis of the benefits of a home garden project on children's nutrition in an informal settlement in the Vaal Triangle in South Africa. The home garden project was motivated by the prevalence of household food insecurity and malnutrition identified in this settlement.

METHODOLOGY

Growth monitoring reflects children's nutritional status through anthropometric measures. These variables include height, weight and head circumferences for children from birth to two years of age (Napier, 2006). Anthropometric measures determine current and past nutrition and health status. They help in planning interventions and implementing strategies for at-risk individuals (Ojo et al., 2000). The United Nations High Commission for Refugees, the World Food Programme (WFP) and the World Health Organisation (WHO) strongly advocate the use of weight-for-age (WFA) and height-for-age (HFA) as indicators of wasting and stunting respectively (Ojo et al., 2000). UNICEF also recommends weight-for-age (WFA) as an indicator of underweight and weight-for-height is an indicator of recent malnutrition (Food and Agriculture Organisation (FAO, 1998).

Forty children from participating households who were aged between two to five years were selected to participate in the study. The sample population consisted of 22 boys and 18 girls. The anthropometric measurements were taken by measuring and weighing the participant before and at the end of study. The participants were weighed on a calibrated electronic scale and their heights on height stick. The procedure was repeated twice for accuracy (MacFarlane, 1995).

Anthropometric measurements (weight and height) were plotted on Road to Health Charts. The weight and height measurements were classified according to percentiles used by National Centre for Health Statistic (Mahan and Escott-Stump, 2004). Height-for-weight, height-for-age and weight-for-age z scores were estimated to determine wasting, stunting and underweight pre- and post-home gardens. The body mass index (BMI) was not used because the children are still growing and BMI indicates malnutrition over a period, while height-for-age indicates recent malnutrition.

A double entry data system was used to minimise data entry errors, and all discrepancies were corrected by referring to the survey instruments. Paired sample t-tests were carried out to determine the significance of pre- and post-project data. The weight and height measurements were classified according to percentiles used by National Centre for Health Statistic. Height-for-weight, height-for-age and weight-for-age z scores were estimated to determine wasting, stunting and underweight pre- and post-home gardens. The z-score means and standard deviations (SDs) of the three nutritional indicators [height-for-age (HAZ); weight-for-age (WAZ) and height-for-weight z-scores (HWZ)] were calculated and analysed. All data were analysed with the WHO AnthroPlus software 1.0.2, using the cut-offs set out in the 2006 WHO standard. Data were excluded if a child's HAZ was below -6 or above +6, WAZ was below -6 or above +5, or HWZ was below-5 or above +5. Finally, linear regression was used to explore relationships between dietary diversity, nutrient intakes and anthropometric measurements. The significant model was refined using step-wise linear regression.

RESULTS AND DISCUSSION

The children were categorised into three groups at the start of the project: children of 24-35 months (four boys and one girl), 36-47 months (four boys and five girls) and 48-60 months (14 boys and 12 girls). The analysis indicates that boys aged 24 to 35 months were severely stunted, with a mean height-for-weight z-score of -4.41 (below the third percentile) – see Table 1. The mean scores increased slightly after implementation of the project to -4.97 (but still below the third percentile). For boys aged 36 to 47 months, 25 per cent were stunted at the start of the project and 50 per cent by the end of the project, showing deterioration in nutritional status. Twenty-one per cent of the older boys (48 – 60 months) were within their normal height-for-age range pre- and post-project.

[See table 1]

These finding show that the boys between 24 and 35 months benefited marginally, but the nutritional status of boys between 36 and 47 months deteriorated over the project period. Many children were undernourished at the start of the project. The low pre and post project carbohydrate intake is concerning. The paired sample t-tests did not find statistically significant differences between the pre- and post-project means for height-for-age z-scores for the whole sample, but found a significant difference pre- and post-project for boys (Table 2), especially among the youngest children.

[See table 2]

All girls aged 24 to 35 months were below -2SDs for height-for-age at the start of the project. At the end of the project, only 50 per cent of the same girls were stunted (Table 2), showing an encouraging benefit from the project. However, for girls aged 37 to 47 months, 25 per cent were below -3SDs below the height-for-age norms at the end of the project, compared with 20 per cent pre-project implementation, showing a concerning deterioration in nutritional status, as with boys of the same group. Although girls between 24 and 35 months showed an improvement in terms of height-for-weight ratios, they were on average severely stunted, with a mean height-for-age z-score of -3.02 (below the third percentile) pre- and -2.31 SDs (below the fifth percentile) post-project. On average, girls between 36 and 47 months were also stunted pre-project (-2.39 which is below the third percentile) but only at risk of stunting (-1.86 and below the 25th percentile) at the end of the project. The sample of older girls were better nourished, with a mean for height-for age of (-0.88 SDs, below the 50th percentile) pre-project and -0.92 SDs (below the 50th percentile) post-project. Changes in girl's height-for-age ratios were not statistically significant.

The z-score means for height-for-age were generally lower among girls than boys, indicating that the girls were better nourished than the boys. There were slight changes in the z-score means and standard deviations for height-for-age post-project implementation, but changes in height-for-age rations were not statistically significant for the whole sample or for the sub-sample of girls. However, the paired sample t-tests showed that there was a significant difference in the mean z-scores for the pre- and post-project data. The data set was too small to split the data further into gender and age groups.

Twenty-five percent of boys aged 24 - 35 months and seven per cent of boys aged 48-60 months fell below -2SDs (third percentile) in terms of weight-for-age, indicating they were underweight (Table 6). Boys aged 24 - 35 months had mean weight-for-age z-scores of -0.24 and -0.43 (below the 50th percentile) pre- and post-project respectively. The weight-for-age means for boys aged 36 - 47 months changed slightly from -0.15 to -0.47 below the 50th percentile and -0.07 to -0.28 below the 50th percentile for boys aged 48 - 60 months, showing deterioration in their status over the duration of the project. On average, boys' weight-for-age ratios deteriorated over the project period. However, these differences were not found to be statistically significant.

[See table 3]

Twenty-five per cent of girls between the ages of 36 and 27 months fell below -2SDs for weight-for-height, indicating they were underweight (Table 7). A slight change was observed in weight-for-age ratios among girls between 36 and 47 months, where the weight-for-age means changed from -0.14 (below the 50th percentile) pre-project to -0.5 (still below the 50th percentile) post-project, again indicating a deterioration of nutritional status, with a worrying number of underweight girls both pre and post project implementation. However, these changes were not statistically significant.

[See table 4]

Most boys were adequately nourished in terms of weight-for-height, except for a concerning 25 per cent of boys aged 24 to 35 months who had z-scores below -3SD for height-for weight, and were considered wasted. All girls were adequately nourished, as indicated by the weight-for-height z-score analysis, but the height-for-weight z-scores deteriorated over the period of the project, except for girls aged 36 – 47 and 48 – 60 months (whose ratios improved) showing that this indicator of current nutritional status did not improve through the garden project. This finding supports the results above, although the differences pre-and post-project were not statistically significant.

Results from this study highlight that malnutrition is problematic among children of all age groups in this sample. Home gardens had no statistically significant impact on anthropometric measurements of the children. A concerning, negative statistical difference was found between pre- and post-project height-for-age z-scores for boys, showing significant deterioration of nutritional status among boys. Statistically significant increases in anthropometric measurements were not found and, in fact, some anthropometric indicators worsened over the duration of the garden project.

CONCLUSIONS AND RECOMMENDATIONS

Until the impact of home gardens on children's nutrition can be empirically established, caution should be exercised in promoting home gardens as the ultimate solution to food insecurity and malnutrition. It seems presumptuous to promote home gardens as a panacea for child malnutrition. Therefore, governments and agencies should be cautious in how such programmes are promoted, designed, targeted and managed. Feeding schemes, subsidies and social protection that are targeted at pre-school children may be more effective than home gardens. Growth monitoring is essential to identify nutritionally at-risk and affected children and for effective targeting of interventions. Nutrition education helps in attitude changes towards food and healthy living habits and should be widely implemented and targeted at caregivers.

Home gardening needs to be coupled with nutrition education so that behaviour modification can also take place. Nutrition education may include the relationship between different vegetables and health, the identification of which vegetable provides which nutrient, preparation methods that preserve the nutritional value of the vegetables e.g. cooking with little water or oven steaming the vegetables. Those vegetables can be mashed for small children instead of buying bottled food. The addition of a little bit of fat to the vegetables will increase the nutrient value. The importance of a home garden as a source of nutrients should also be emphasised. In addition, the caregivers should also be provided with knowledge on how to harvest in such a way that they can preserve the seeds for future use without having to buy seeds every season.

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Table 1: Height-for-age, 24-60 months boys and girls, 2004

Age in months	Number of children	Mean for height-for-age		SD for height-for-age	
		Pre	Post	Pre	Post
Boys					
24-35 (n=4)	4 (18%)	-4.41	-4.97	0.18	0.30
36-47 (n=4)	4 (18%)	-1.10	-1.76	1.30	1.28
48-60 (n=14)	14 (64%)	-0.75	-1.22	1.42	1.18
Girls					
24-35 (n=1)	1(6%)	-3.02	-2.31	0.00	1.80
36-47 (n=5)	5 (28%)	-1.86	-2.39	1.46	1.70
48-60 (n=12)	12 (64%)	-0.88	-0.92	1.05	0.88

Table 2: Paired sample t-test statistics for nutrition indicators for the pre- and post-project, 2004

Z-score	**t-value**	**Df**	**Sig. (2-tailed)**
Whole sample			
Height-for-age	1.279	39	0.208
Height-for-weight	-1.137	39	0.262
Weight-for-age	-0.269	39	0.790
Boys			
Height-for-age	2.446	16	0.026**
Height-for-weight	0.205	16	0.840
Weight-for-age	-0.722	16	0.481
Girls			
Height-for-age	0.326	22	0.747
Height-for-weight	-1.568	22	0.131
Weight-for-age	0.059	22	0.954

Note: * denotes statistically significant at the 99 per cent level and ** at the 95 per cent level.

Table 3: Weight-for-age, 24-60 months boys and girls, 2004

Age in months	Number of children (percentage of sample)	Mean weight-for-age z-score		Mean SDs for weight-for-age	
		Pre-project	Post-project	Pre-project	Post-project
Boys					
24-35 (n = 4)	4 (18%)	-0.24	-0.43	2.09	1.77
36-47 (n=4)	4 (18%)	-0.15	-0.47	0.19	1.11
48-60 (n=14)	14 (64%)	-0.07	-0.28	1.15	1.31
Girls					
24-35 (n=1)	1(6%)	-0.97	-0.02	0.00	1.10
36-47 (n=5)	5 (28%)	-0.14	-0.50	0.98	1.20
48-60 (n=12)	12 (64%)	-0.04	-0.18	0.79	0.84

Table 4: Height-for-weight, 24-60 months boys and girls, 2004

Age in months	Number of children (percentage of sample)	Mean height-for-weight		SD height-for weight	
		Post-project	Post-project	Pre-project	Post-project
Boys					
24-35 (n = 4)	4 (18%)	1.65	2.44	0.71	0.53
36-47 (n=4)	4 (18%)	0.83	1.06	0.46	0.74
48-60 (n=14)	14 (64%)	0.64	0.87	1.17	0.98
Girls					

24-35 (n=1)	1(6%)	1.35	2.09	0.00	0.16
36-47 (n=5)	5 (28%)	1.92	1.57	0.86	0.39
48-60 (n=12)	12 (64%)	0.72	0.57	0.83	0.67