

## NUTRITION AND MOTOR DEVELOPMENT DURING EARLY CHILDHOOD: STARTWELL GROW – TRANSFORMING CHILDHOOD NUTRITION FOR A BRIGHTER FUTURE

Chanelle Kemp, Schae-Lee Olckers & Org van der Wath

### ABSTRACT

In South Africa, 1.6 million children under 6 years old are enrolled to attend Early Learning Programmes. A staggering 65% of children attending an Early Childhood (ECD) centre in South Africa fail to thrive by the age of five. This shortcoming places a high percentage of school beginners at risk for developmental problems associated with inadequate motor skills. Motor development has been reported as a crucial part of a learner's overall development and is intertwined into many different facets of the growing child. The growth and development of young learners can be influenced by many factors, with nutrition and the surrounding environment being highlighted as major contributing factors. StartWell GROW cereal is a groundbreaking nutrient-rich ready-to-eat meal, which could revolutionise childhood nutrition in learning environments in South Africa. This innovative cereal, boasting a unique blend of multi-wholegrains, multi-legumes, dairy, and essential vitamins and minerals, has the potential to become a game-changer in the quest to nourish underprivileged children and provide them with the fuel they need to thrive. The aim of this review article is to provide a foundation for the upcoming quantitative research study which will determine the effects of the StartWell GROW nutrient-rich-ready-to-eat meal on the fundamental movement skills, visual-motor integration, and body composition of children in ECD centres.

### KEYWORDS

nutrition, motor development, early childhood,

transforming, StartWell-GROW

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#### — *Dr C Kemp\**

ORCID ID: 0000-0003-4212-8902

Faculty of Education

School of Psycho-Social Education

Department of Movement Education

North-West University

Potchefstroom 2531

South Africa

Email: [chanelle.kemp@nwu.ac.za](mailto:chanelle.kemp@nwu.ac.za)

\*Corresponding author

#### — *Dr S Olckers*

ORCID ID: 0000-0002-4893-8001

StartWell Foundation

Springs 1559

South Africa

Email: [schae@startwellfoundation.org](mailto:schae@startwellfoundation.org)

#### — *Mr O Van der Wath*

ORCID ID: 0009-0006-1801-3856

StartWell Foundation

Springs 1559

South Africa

Email: [org@startwellfoundation.org](mailto:org@startwellfoundation.org)

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### ARTICLE INFO

Submitted June 2024

Revision September 2024

Accepted September 2024

DOI: <https://dx.doi.org/10.4314/jfec.v1i1.271354>

## INTRODUCTION

Childhood undernutrition remains prevalent in South Africa with 27% of children under the age of five suffering from stunting (short for their age), 3% of children suffering from wasting (thin for their height), and 6% are underweight (low weight for their age) (Department of Health *et al.* 2017). To ensure appropriate growth and development, young children should follow a minimum acceptable diet (a composite indicator formulated from minimum dietary diversity and minimum meal frequency) (May *et al.* 2020). Recent statistics indicated that the percentage of South African children with a minimum acceptable diet increased with increasing household wealth (Department of Health *et al.* 2017). The overall development of children will adversely be affected if the high levels of undernutrition in children are left unchecked (May *et al.* 2020). The fact that COVID-19 and the associated lockdown has intensified child malnutrition, is a further concern. According to the South African National Income Dynamic Study (NIDS), child and adult hunger increased from 15% to 22% between 2017 and 2020 due to poverty and unemployment, and that percentage increased during COVID-19 (Spaull *et al.* 2020; Alaba *et al.* 2022; De Wet-Billings 2023). Childhood undernutrition and food insecurity influence a child's cognitive abilities, language, social-emotional, and motor development (Petrou & Kupek 2010; Said-Mohamed *et al.* 2018; Worku *et al.* 2018).

Research indicates that proper nutrition is crucial for the growth, overall health, and development of infants and toddlers (Bustamante-Sanchez *et al.* 2022; Clark *et al.* 2020; Nurliyana *et al.* 2016). In South Africa, 1.6 million children (72%) under 6 years old were enrolled to attend Early Learning Programmes in 2022 (Department of Basic Education 2022). A staggering 65% of children attending an Early Childhood (ECD) centre in South Africa are not 'On Track' (meaning that they may be struggling to meet expected developmental benchmarks) for cognitive and/or motor development

(Department of Basic Education *et al.* 2022). A child's diet plays a critical role in the development of their muscles, bones, and nervous system, all of which are integral components of motor development (Sutapa *et al.* 2021).

Motor development and nutrition are closely linked, as proper nutrition is essential for developing and maintaining a child's motor skills, with studies indicating correlations between nutritional status, weight status, and motor skill development (Wang *et al.* 2018). A study involving 750 children in Uganda found that food insecurity significantly affects the gross (e.g., crawling, standing, walking) and fine motor skills (e.g., grasping, picking up small objects, hand-eye coordination) of 12- to 25-month-old children (Mbabazi *et al.* 2024), indicating that those experiencing food insecurity may encounter challenges in developing these essential motor skills. In a national South African sampling survey of early development in 5,222 children aged 50 to 59 months, of which 5.1% were stunted, Tredoux *et al.* (2023) report that more than 50% of the children in the study were falling behind concerning their early learning outcomes measures, which included gross motor skills.

Motor development plays an important role in the development of children and can influence the skills needed for optimal development and an active lifestyle later in life (Martorell 2017; Van Zyl & Van Wyk 2021). During the preschool years (ages three to six), children start to develop fundamental movement skills (FMS), which form the foundation for more complex movement and sports skills (Shu-Jung & Shu-Chu 2020). As FMS in children also forms the foundation for academic skills such as reading, writing, and mathematics (Gallahue *et al.* 2020; Macdonald *et al.* 2018; Magistro *et al.* 2022), they are essential in the development of school readiness skills (Chang & Gu 2018).

Motor proficiency, which constitutes well-developed motor skills, plays a major role in children's physical, psychological, and social

development (Haywood & Getchell 2020). Also, several studies have indicated a positive correlation between motor proficiency and higher physical activity levels in preschool children (Figueroa & An 2017; Jones *et al.* 2020; Ma & Luo 2023), indicating that motor proficiency during early childhood is the foundation for an active lifestyle. Furthermore, a higher level of motor proficiency in children is beneficial for improving health-related fitness and increasing muscle strength and endurance (Rui & Heng 2017).

### Stunting

Linear growth, the most comprehensive indicator of a child's well-being, is hindered in millions of young children worldwide due to suboptimal health conditions, inadequate nutrition, infections, and insufficient care, leading to severe, irreversible physical and cognitive damage associated with stunted growth (De Onis & Branca 2016; Perkins *et al.* 2017). In South Africa, despite its status as a higher middle-income country (World Bank, 2024), one in four children under five are stunted, placing it among the 34 nations accounting for 90% of the world's stunted children (Department of Health *et al.* 2019; Galasso & Wagstaff 2019). The long-term impact of stunting, defined as the percentage of children whose height-for-age is below two standard deviations from the median of the WHO growth standards derived from a sample of healthy children across diverse settings, can become intergenerational if left unaddressed (Headley *et al.* 2018; WHO 2006). Similarly, children are considered severely stunted if their height-for-age is below 3 SDs from the WHO child growth three standard deviations below the median for the same age and sex.

Stunting can impact a child's development from conception through the first few years of life, with maternal and child nutrition playing crucial roles in determining growth (Soliman *et al.* 2021). Stunting often goes unnoticed in communities where short stature is common and considered normal, with difficulties in visually identifying affected children and a lack

of routine assessment in primary health care contributing to the delayed recognition of the problem's extent (Anggraeni *et al.* 2023; De Onis & Branca 2016). Stunting is significant due to its lasting social impact, as early growth deficits have been linked to long-term effects on cognitive and social development (Burger *et al.* 2022; McGovern *et al.* 2017). Short-term effects include higher rates of illness and death, developmental issues such as cognitive, motor, and language delays, greater susceptibility to infections and chronic diseases as well as increased economic burden due to the costs of caring for sick children (Das *et al.* 2018; Wand *et al.* 2024). Over time, stunting leads to decreased reproductive health, diminished concentration in learning, and lower work productivity (Suratri *et al.* 2023).

Children who have a sufficient food supply, with enough calories to avoid hunger can still be at risk of stunting if their diet lacks essential nutrients, a condition known as 'hidden hunger'. Many South African households feed their children maize-based meals and sugary foods that fill the stomach but lack essential proteins and vital micronutrients such as vitamins, zinc, and iron (Faber 2004; Steyn *et al.* 2016). To prevent stunting, children need both enough food and the essential nutrients for growth and development. However, hidden hunger, caused by processed foods lacking in nutrients despite their calorie density, can lead to both obesity and stunting when children consume excess calories without the necessary nutrients, a problem spreading to developing countries (Reardon *et al.* 2021). The burden of stunting carried by children primarily persists due to a significant knowledge gap among parents, as many are unaware that staples like oats, maize meal porridge, samp, and beans, although readily available, are inadequate for promoting healthy child growth and development.

Insufficient energy-protein intake has been linked to higher stunting risk in children under five (Maulidiana & Sutjiati 2021). The decline in recognizing protein's importance in global

health started in the early 1970s with a shift toward carbohydrates fortified with vitamins and minerals. This change was influenced by a 1973 document in *The Lancet* called the "Great Protein Fiasco," which provided a scientific-sounding reason to prioritise inexpensive carbohydrate-based solutions, therefore creating a misunderstanding (Semba 2016). The consequences of this shift have been profound, with persistently high rates of stunting being one of the most devastating outcomes in children worldwide (Soliman *et al.* 2021). Infants and young children need a balanced diet with adequate amounts of protein, carbohydrates, and healthy fats which is crucial for brain development, immune system function, and overall growth. Animal-source foods provide high-quality proteins that are more readily absorbed than those from plant-based foods, with milk, meat, and eggs being the only sources containing sufficient amounts of iron, zinc, calcium, and riboflavin for complementary feeding (Headley *et al.* 2018).

The WHO guideline for feeding infants and young children aged 6- to 23-months old is a significant benchmark in child nutrition, offering a clear and practical framework for caregivers, and emphasizing crucial insights into the nutritional requirements of infants and young children (WHO 2023). The guideline strongly advocates for exclusive breastfeeding during the first six months of a child's life and recommends animal milk as a suitable alternative for infants aged 6 to 11 months who are not breastfed. As children begin transitioning to solid foods at 6 months, the WHO guideline emphasises the importance of offering a variety of foods, particularly animal-source foods, fruits, and vegetables, in their diets up to 24 months old, highlighting their critical role in providing essential nutrients during this vital period of growth and development (WHO, 2023).

The WHO guideline provides a comprehensive and practical approach to complementary feeding, emphasising the importance of diverse solid foods and nutrient-rich animal-source foods in the diets of infants

and young children, which is crucial for supporting optimal growth and development, particularly in resource-poor areas. With this guideline as a reference point, it has the potential to unify efforts in child growth and development by offering a common, easy-to-understand framework that streamlines practices across non-profit organisations (NGOs) and other stakeholders.

### **The StartWell Foundation**

One major concern in food processing is the significant influence of private food enterprises that prioritise shareholder values over consumer benefit, often using food recipes to create unhealthy, non-nutritious products (Fanzo *et al.* 2023). These products are aimed at ensuring continuous consumption, with innovation and efforts primarily focused on maximising profits and shareholder returns rather than addressing genuine consumer needs and well-being (Wood *et al.* 2021; Fanzo *et al.* 2023). The StartWell Foundation was established to catalyse necessary change, with its organisational structure, business model, and values dedicated to actively pursuing, creating, and enhancing food recipes to maximize value for their beneficiaries. As the majority shareholder of Startwell Foods (Pty) Ltd, the Startwell Foundation provides essential nutritional support to babies, toddlers, and children in early learning centers within resource-poor communities by offering Startwell GROW, a balanced, nutrient-dense cereal meal served five days a week, prioritising quality, accessibility, and affordability to benefit these children effectively (<https://startwellfoundation.org/>).

These meals were designed to be ready-to-eat, ensuring convenience and accessibility for both the children and the school caregivers, utilising extrusion cooking, blending, and fortification methods in its factory in Springs, Gauteng (South Africa) to ensure their nutritional quality and food safety (Faliarizao *et al.* 2024). The factory's current capacity allows it to provide cereal meal portions to approximately 200,000 children

daily. Interventions in ECDs for complementary feeding typically target children aged 6 to 24 months, a critical phase within the first 1000-day period where breastmilk alone becomes insufficient to sustain children (WHO 2009; Harrison *et al.* 2023). However, caregivers often face challenges in introducing diverse and nutritious foods due to inadequate availability and variety, particularly in low and resource-poor communities, where this age group is most vulnerable to stunting (Burger *et al.* 2022). The StartWell Foundation also aims to address the nutritional needs of vulnerable, stunted children during this critical stage of their growth and development by offering balanced, accessible, scalable, and affordable meals tailored for chronically malnourished children in resource-poor communities.

With the belief that this targeted approach can significantly impact the health and well-being of these children, they claim to ensure that children receive adequate nutrition to support both their physical and cognitive development. Along with tackling the issue of processed versus ultra-processed foods (Levine & Ubbink 2022), the StartWell Foundation undertook a journey to explore the potential benefits of specific processing methods and ingredients, aiming to achieve a balance between nutritional quality, accessibility, and affordability. This shift led to a re-evaluation of the role of processed foods in these interventions, emphasising the positive aspects of processing foods to develop recipe solutions that could significantly improve the nutritional status of children in resource-poor communities.

### **The nutrient-dense ready-to-eat meal: StartWell GROW**

Research indicates that the primary driver of stunting is protein-energy malnutrition (Endrinikopoulos *et al.* 2023; Perumal *et al.* 2017; Rasheed *et al.* 2023). Therefore, the StartWell Foundation's focus on the development of the StartWell GROW nutrient-dense ready-to-eat meal was the optimisation of their product's protein composition.

Currently, proteins in StartWell GROW are obtained from a balanced mix of sources, i.e., 44% from dairy, 29% from four whole grains, and 27% from two legumes (chickpeas and peanuts) (see Table 1), thus ensuring a careful balance of a complete protein profile that supports healthy growth and development in children. The Startwell GROW meal was developed in alignment with the WHO recommendations, with a particular focus on providing high-quality bioavailable proteins in appropriate quantities to support the nutritional needs of infants aged 6 months to 2 years (WHO 2023).

In the comprehensive approach to addressing protein malnutrition, it is crucial to tackle prevalent micronutrient deficiencies among affected children, emphasising not only macronutrients (proteins, fats, and carbohydrates) but also incorporating essential micronutrients such as vitamins A, B, C, and D, along with minerals like iron, calcium, magnesium, and potassium (Penny 2012; Galani *et al.* 2022; Endrinikopoulos *et al.* 2023). By providing a nutrient-dense meal with balanced proportions of both macro- and essential micronutrients, the StartWell GROW meal aims to significantly contribute to the nutritional well-being of children in resource-poor communities. Table 1 provides a detailed overview of the nutritional profile of StartWell GROW, which was developed in accordance with WHO recommendations to meet the dietary needs of infants and young children.

While it may be challenging to discern significant differences between StartWell GROW and traditional maize, soya, and sugar recipes usually given in feeding schemes in their ready-to-eat forms, a closer examination reveals a distinct composition and nutritional profile that sets StartWell GROW apart. Firstly, the total added sugar content has been minimised as much as possible, ensuring that the meal contributes to a healthy diet. Furthermore, the incorporation of a variety of whole grains, legumes, and dairy products provides a diverse range of macro and micronutrients and flavours (Table 1), which is

not only beneficial for nutrition but also considers cultural and traditional preferences, aiming to make the morning meal enjoyable for children.

Each 50g serving provides 30 to 50% of the Harmonized Average Requirements (H-ARs) for essential vitamins and minerals for children aged 4 and older, with H-ARs serving as science-based guidelines that represent the average nutrient amount required to meet the needs of 50% of healthy individuals in a given group, supporting internationally accepted dietary recommendations (Allen et al., 2020). Furthermore, the elimination of preservatives in favour of safe ingredients is also accompanied by the addition of probiotics, which promotes digestive health by restoring the natural balance of gut bacteria and strengthening immunity by supporting the body's defences against harmful pathogens. StartWell GROW offers a selection of six flavours, carefully designed to appeal to the diverse tastes of children.

Overall, StartWell GROW was designed to be a nutritious, delicious, and culturally appropriate meal option for children in early learning centres, supporting their health and well-being. The StartWell Foundations' feeding scheme program offers a 50g meal tailored for growing children at an affordable rate of just R70 for 21 portions per month. This cost includes delivery and administrative expenses, ensuring that nutritious meals are accessible to all children in need. Meals are donated through Corporate Social Investment (CSI) and philanthropic contributions that are delivered to selected NGOs working with ECDs in resource-poor communities, where these NGOs handle the final-mile logistics, quality control, distribution and comprehensive reporting to ensure efficient and impact delivery. To ensure that the StartWell Foundations' efforts are effective and impactful, a structured and independent study will be performed in the form of an extended project. This project represents a significant opportunity to nourish underprivileged children, providing them with the essential nutrients they need to thrive. It is furthermore

a commitment to building a brighter, healthier future for these children, ensuring that they have the foundation they need to become tomorrow's leaders.

## OBJECTIVES

The objective of this study will be to determine the effects of the StartWell GROW nutrient-rich-ready-to-eat meal on the fundamental movement skills, visual-motor integration, and body composition of children in ECD centres.

## RESEARCH METHODOLOGY

The project will employ quantitative research within a positivist framework, utilising a pre- and post-test design. The study will focus on a population of a minimum of 200 three-to-five-year-old children in the Kenneth Kaunda district (North-West Province, South Africa), with both an experimental group and a control group consisting of 100 participants each. Baseline testing will be done in April 2025 and the intervention programme will commence after the completion of the baseline tests. The duration of the intervention programme will be 6 months. The children in the intervention group will receive a 50g StartWell GROW nutrient-dense cereal meal once a day for every day of the week for 6 months, while the control group will follow their normal diet. The kitchen staff of the intervention school will receive training before the implementation of the project.

In order to test the effects of the intervention programme on the children's growth and motor skills, quantitative data will be collected through a standardized Fundamental movement skill (FMS) test, a Visual-motor integration (VMI) test, as well as measurements of body composition (stature, weight, and skinfolds). The FMS- and VMI tests, as well as body composition, will be conducted before and after the StartWell GROW intervention program for both the intervention and control groups by trained Kinderkineticists. Post-graduate students will

**TABLE 1: TYPICAL NUTRITIONAL INFORMATION OF THE STARTWEELL GROW NUTRIENT-DENSE CEREAL MEAL, ORIGINAL FLAVOUR**

<b>Ingredient List</b>				
Whole Grain Ground Wheat (Gluten) (18.59%), Whole Grain Ground Chickpeas (16.83%), Skimmed Milk Powder (Cow's Milk) (12.50%), Whole Grain Ground Maize* (11.14%), Full Cream Milk Powder (Cow's Milk) (9.00%), Whole Grain Ground Sorghum (7.87%), Whole Grain ground Oats (Gluten) (7.87%), Buttermilk Powder (Cow's Milk) (6.00%), Brown Sugar (4.00%), Whole Grain Peanuts (3.39%), Vitamins and Minerals (Vitamin A Palmitate, Nicotinamide, Vitamin C, Vitamin D3, Vitamin E, D-Biotin, Choline Bitartrate, Calcium Carbonate, Potassium Iodide, Iron Electrolytic, Zinc Oxide, Selenium AAC, 9 Strain Probiotic) (1.28%), Milk Protein Concentrate (Cow's Milk) (1.00%), Iodized Salt (0.50%), Sweetener (Steviol Glycosides) (0.025%).				
<b>Nutrient</b>	<b>UOM</b>	<b>Per 100g</b>	<b>Per 50g serv</b>	<b>% NRV ** per 50g</b>
Energy	KJ	1557	778	
Protein	g	19.4	9.7	17.3
Carbohydrates	g	60.6	30.3	
of which total sugar	g	19.2	9.6	
of which total lactose	g	13.1	6.6	
of which total sucrose	g	4.0	2.0	
Total Fat	g	7.4	3.7	
of which saturated fat	g	2.6	1.3	
of which monounsaturated fat	g	2.0	1.0	
of which polyunsaturated fat	g	1.7	0.8	
Omega 3 Fatty Acids	mg	62	31	
Omega 6 Fatty Acids	mg	1500	750	
Dietary Fiber ***	g	6.8	3.4	
Sodium	mg	316	158	
Probiotics	cfu/g	1 Bil	500 Mil	
GI Category Claim ****		Low GI		
<b>Vitamins and Minerals</b>				
Vitamin A (Retinol)	mg	235.7	117.9	13.1
Vitamin B1 (Thiamin)	mg	0.4	0.2	15.2
Vitamin B2 (Riboflavin)	mg	0.8	0.4	30.5
Vitamin B3 (Nicotinamide)	mg	5.7	2.8	17.7
Vitamin B5 (Pantothenic Acid)	mg	2.9	1.5	24.4
Vitamin B6 (Pyridoxine)	mg	0.4	0.2	11.1
Vitamin B9 (Folic Acid)	µg	123.1	61.5	15.4
Vitamin B12 (Cobalamin)	µg	0.9	0.4	18.3
Vitamin C	mg	23.5	11.7	11.7
Vitamin D (Cholecalciferol)	µg	8.6	4.3	28.7
Vitamin E (Tocopherol)	mg	5.0	2.5	16.6
Vitamin H (Biotin)	µg	18.2	9.1	30.3
Vitamin K	µg	2.2	1.1	0.9
Choline	mg	126.5	63.2	11.5
Calcium	mg	733.7	366.8	28.2
Chromium	mg	0.0	0.0	0.0
Copper	mg	0.3	0.2	18.9
Iodine	mg	60.2	30.1	20.1
Iron	mg	11.7	5.8	32.4
Magnesium	mg	116.4	58.2	13.9
Molybdenum	ug	1.7	0.8	36.2
Manganese	mg	16.7	8.3	18.5
Phosphorous	mg	414.1	207.0	16.6
Potassium	ug	739.7	369.8	
Selenium	mg	20.5	10.3	18.7
Zinc	mg	4.9	2.5	22.4
UOM = Unit of measurement, serv = serving, NRV = Nutrient Reference Value, Bil = Billion, Mil = Million. * Maize may be produced using genetic modification. ** Nutrient Reference Values for individuals 4 years and older expressed per single serving based on Regulation R146 and R429. *** Values obtained from a SANAS Accredited Laboratory. **** Low GI foods, when eaten regularly in moderate portions at a time, generally provide a slow release of energy and improve blood glucose control. It may also elicit a higher state of satiety and possibly lower the risk of non-communicable diseases in the long term.				

monitor the feeding schedule of the children in the intervention school for 6 months for quality control. Other aims of the project will include food handling practices and nutrition education for the parents. Approval will be obtained from the Health Research Ethics Committee (HREC) of North-West University and the North-West Department of Education and North-West Department of Health to conduct this research. Permission was already obtained from the principals of the schools. Informed consent will be obtained from the parents or legal guardian after explaining the purpose of the study and methodology. The Centre of Excellence for Nutrition (CEN) at the North-West University, an independent research institution known for its rigorous, evidence-based methodologies, will conduct the study on the StartWell GROW nutrient-rich-ready-to-eat meal. This will ensure that findings on fundamental movement skills, visual-motor integration, and body composition of children in ECD centres are obtained through an impartial and scientifically objective lens, free from commercial or external influence.

## CONCLUSION

Prioritising interventions that enhance, safeguard, and support preschoolers' food security and nutrition throughout this crucial and time-sensitive developmental stage is necessary if the children of South Africa are to grow up to be healthy, intelligent, socially, and economically capable adults (Thorogood *et al.* 2020). This StartWell GROW project can contribute to nourishing underprivileged children and provide them with the fuel they need to thrive. The project will be aimed at building a brighter, healthier future for undernourished children.

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