

Title of the Impact Case Study

Combating Hidden Hunger through the Development and Commercialisation of Nutri-Caro-E Fortification Technology

Submitting University

Cape Peninsula University of Technology (CPUT)

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Summary of the Impact

Hidden hunger, caused by deficiencies in vitamins and minerals despite adequate food intake, remains a major public health challenge in South Africa, particularly among children and vulnerable populations. Research undertaken by the Functional Foods Research Unit (FFRU) at the Cape Peninsula University of Technology (CPUT) led to the development of Nutri-Caro-E, a patented micronutrient fortification technology designed to improve nutritional status through incorporation into commonly consumed food products.

The technology demonstrated measurable improvements in micronutrient status among pre-school children attending informal crèches in the Eastern Cape. Following successful development and validation, Nutri-Caro-E was licensed to Sozo Foods (Pty) Ltd and incorporated into fortified food products including maize meal, instant cereals, peanut butter products, and stock cubes. Through its incorporation into products distributed to vulnerable communities, including school children and elderly beneficiaries, the technology translated university research into a practical response to hidden hunger and micronutrient deficiencies.

Underpinning Academic Work

The impact arose from a programme of nutritional research undertaken over several decades by the late Professor A.J. Spinnler Benade (1990-2003) together with Professor Maretha Opperman who joined him in 2005 .

The foundational research originated during Professor Benade's tenure at the South African Medical Research Council (SAMRC), where studies focused on omega-3 fatty acid metabolism, atherosclerosis and micronutrient deficiencies, including vitamin A deficiency among South African children. Following his retirement from the SAMRC, Professor Benade and Professor Opperman established the Functional Foods Research Unit (FFRU) at CPUT in 2009 with support from a CPUT Research and Innovation Grant. Research undertaken through the FFRU focused on understanding nutritional deficiencies affecting vulnerable populations and translating scientific knowledge into practical food-based interventions. The research identified a persistent deficiency in vitamin A and other micronutrients despite existing fortification programmes. These findings informed the development of Nutri-Caro-E, a patented micronutrient fortification technology containing carotenoids derived from red palm oil together with micronutrients including iron, zinc, selenium and copper.

The research subsequently evaluated the effectiveness of the nutritional approach through community-based intervention studies and informed the development of commercially deployable fortified food products.

CPUT's Technology Transfer and Industry Linkages Office played a key role in identifying, protecting and commercialising the intellectual property arising from the research, supporting the transition of Nutri-Caro-E from laboratory innovation to a market-ready technology.

Narrative Description of the Impact

1. Addressing Hidden Hunger in South Africa

Hidden hunger occurs when individuals consume sufficient calories but remain deficient in essential vitamins and minerals required for healthy growth, cognitive development, immune function and overall wellbeing. The condition disproportionately affects children and vulnerable communities and can have lifelong consequences when deficiencies occur during early childhood.

National nutrition studies have identified persistent micronutrient deficiencies among South African children despite mandatory food fortification programmes. Deficiencies in vitamin A and other micronutrients continue to affect growth, health outcomes and educational potential.

Recognising the need for practical and sustainable nutritional interventions, researchers at CPUT developed Nutri-Caro-E, a micronutrient fortification technology designed to improve nutritional intake through foods already consumed by vulnerable communities.

2. Developing a Practical Nutritional Intervention

Nutri-Caro-E was developed as a patented micronutrient fortification technology containing carotenoids and vitamin E derived from red palm oil together with micronutrients including iron, zinc, selenium and copper.

The technology was specifically designed for incorporation into commonly consumed food products, enabling nutritional enhancement without requiring significant changes to dietary behaviour. This provided a practical mechanism for addressing micronutrient deficiencies among vulnerable populations while supporting broader public health objectives.

The formulation was developed for use in products suitable for large-scale distribution, including maize meal, instant cereals, peanut butter products, stock cubes and other fortified foods.

3. Demonstrating Nutritional Impact

The effectiveness of the nutritional intervention was demonstrated through a community-based study involving pre-school children attending informal crèches in Bethelsdorp in the Eastern Cape. Forty-seven children completed the intervention study. At baseline, the children displayed evidence of significant micronutrient deficiencies, including an unexpected severe vitamin E deficiency affecting 69% of participants.

During the intervention period, children received fortified biscuits containing carotenoids, vitamin E and essential micronutrients. The intervention resulted in significant improvements in vitamin E

status, with deficiency levels declining from 69% at baseline to 10% after six months of intervention and reaching 0% at follow-up. Significant increases in plasma alpha-carotene and beta-carotene levels were also observed.

4. Commercialisation and Translation into Practice

To maximise societal benefit, Nutri-Caro-E was protected through patenting and licensed to Sozo Foods (Pty) Ltd, a South African company established to commercialise nutritional products designed to address deficiencies associated with poverty, illness, poor dietary quality and other health challenges. Through the licensing agreement, Nutri-Caro-E was incorporated into a range of commercially produced fortified food products, enabling the technology to move beyond the research environment and into practical application.

5. Reach and Beneficiaries

The incorporation of Nutri-Caro-E into fortified food products enabled the benefits of the technology to extend beyond the original research setting and reach vulnerable communities where micronutrient deficiencies remain prevalent. Products containing the patented Nutri-Caro-E technology were incorporated into food products including maize meal, instant cereals, peanut butter products, and stock cubes. These products were utilised in initiatives targeting vulnerable population groups, including school children, elderly beneficiaries, pregnant and lactating women and individuals requiring nutritional support.

6. Significance

The significance of the impact lies in the successful translation of university research into a patented fortification technology addressing a major public health challenge. The research demonstrated that fortified food products could significantly improve micronutrient status among vulnerable children and highlighted the continuing need for nutritional interventions among populations affected by hidden hunger. Through patent protection, licensing and incorporation into commercially produced food products, the technology progressed beyond the laboratory and became available through practical food-based interventions.

Timeframe

- 2017–2023: Licensing of Nutri-Caro-E to Sozo Foods (Pty) Ltd.
- 2017–Present: Incorporation of Nutri-Caro-E into fortified food products and deployment through community nutrition initiatives and vulnerable population programmes.

Key Outcomes

- The commercial potential of Nutri-Caro-E led to its licensing to Sozo Foods (Pty) Ltd, a company established to commercialise nutritional technologies, including the patented Nutri-Caro-E fortification technology developed at CPUT.

- Demonstrated reduction in vitamin E deficiency among participating pre-school children from 69% at baseline to 10% after intervention and 0% at follow-up.
- Significant improvements in alpha-carotene and beta-carotene status among participating children.
- Licensing of Nutri-Caro-E to a South African functional foods company.
- Incorporation of Nutri-Caro-E into maize meal, instant cereals, peanut butter products, sauces and stock cubes.
- Distribution of fortified food products to vulnerable population groups, including children and elderly beneficiaries.
- Translation of university research into a practical intervention addressing hidden hunger and micronutrient deficiencies.

Evidence and Sources to Corroborate the Impact

- Patent number ZA 2013/02320
- Licensing agreement between CPUT and Sozo Foods (Pty) Ltd (1 February 2017 – 31 August 2023)
- Product information demonstrating incorporation of Nutri-Caro-E into fortified food products.
- Community nutrition and distribution records relating to Nutri-Caro-E-containing products.
- Photographic evidence of product deployment and community distribution initiatives.
- Opperman, A.M. and Olivier, L. (2023). *Nutritional Status Assessment and Intervention with a Red Palm Oil Biscuit among Pre-School Children Attending Informal Crèches, in the Eastern Cape, South Africa*. African Journal of Food, Agriculture, Nutrition and Development, 23(4):23099–23119.
- <https://www.sozofood.co.za/what-we-do/#team>

Signed off on behalf of the University by a designated Senior Officer (Name, position and email address):

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