



Introducing the **Carotino Biscuit**

The carotene-rich answer to Vitamin A deficiencies and 'hidden hunger'

From nature to you



What is Hidden Hunger?

'Hidden hunger' refers to inadequate intake of micronutrients (vitamins, minerals and trace elements) which leads to detrimental health problems, which although severe, may not always be immediately obvious. Inadequate intake of one such micronutrient, Vitamin A, is a serious global health problem, with an estimated 250 million people at risk worldwide – most of them children.

The consequences of Vitamin A deficiency:

- Can cause eyesight problems and in severe cases, permanent blindness.
- Contributes to poor growth in young children.
- Impairs the immune system and lowers the body's resistance to infections.
- May have serious consequences for pregnant women and their developing babies.
- Adversely affects breast-fed babies whose mothers are Vitamin A deficient.

One way to address this problem is to provide Vitamin-A fortified food to at-risk populations - which is where the Carotino Biscuit can help.

A is for Antioxidants

What is the Carotino Biscuit?

The Carotino Biscuit has been developed by the Carotino Group to help improve the diets of people at risk of 'hidden hunger.' The biscuits are made with Carotino baking fats, derived from red palm fruit – the world's richest natural plant source of carotenes. Not only do the biscuits contain natural beta-carotene (the precursor of Vitamin A in the body) and natural Vitamin E, they have also been fortified with iron to address wider micronutrient deficiencies. The biscuits are part of the Carotino Foods range of nutritionally superior, carotene-rich food products.

What is the Nutritional Composition of the Carotino Biscuit?

Carotino red palm oil is produced in Malaysia from the flesh of red palm fruit using a chemical free-refining process which retains 85% of the carotenoids (alpha and beta carotenes) found in the oil. Carotino baking fats are derived from red palm oil and retain many of the oil's natural antioxidants and fatty acids, which are then transferred into foods which are made with them. They contain naturally occurring Vitamin E tocopherols and tocotrienols, which are a beneficial addition to the diets of many people who are micronutrient deprived. Vitamin E also acts as a natural anti-oxidant which helps prevent polyunsaturated fatty acids from oxidation and increases the shelf-life of the product without synthetic ingredients being added. Carotino baking fats do not contain any potentially harmful trans fatty acids which are present in many other fats which are in widespread use in the baking industry.

Composition of Carotino Baking Fat

Fatty Acids	Mean
Myristic (C14:0)	0.8%
Palmitic (C16:0)	43.6%
Stearic (C18:0)	5.1%
Oleic (C18:1)	40.6%
Linoleic (C18:2)	9.9%

Antioxidant Content per 100g

B-carotene RE	3000
Other carotenoids RE	1833
Alpha-Tocopherols α TE	15
Tocotrienols α TE	10.5%

Nutritional Composition of Carotino Biscuits

Composition	Per 45g (3-4 biscuits)	Per 100g (7-8 biscuits)
Energy (kJ)	844	1875
Protein (g)	3.6	8.1
Carbohydrate (g)	32.1	71.3
Fat (g)	7.2	16.1
Fibre (g)	1	2.3
Sodium (g)	70	156
B-carotene RE	216	483
Other carotenoids RE	132	295
Alpha-Tocopherols α TE	1.08	2.42
Tocotrienols α TE	0.76	1.69
Iron (mg)	5	11

Caring for the Global Community

In the last decade, the Carotino Group has been active in a number of global nutritional intervention studies which aimed to alleviate the macro and micro nutrient deficiencies of at risk populations in the developing world. Several of these studies have been publicised in the United Nations Food and Nutrition Bulletin.

Case Study – Addressing Hidden Hunger in South Africa

A study by researchers of the Nutritional Intervention Research Unit (NIRU) of South Africa found that although few of the school children who received five cooked meals a week as part of a school feeding scheme were underweight, their Vitamin A and iron status was low and they were consequently suffering from 'hidden hunger'. Around 45% of these children were Vitamin A deficient and 24% were anaemic.

It was recognised that there was an urgent need to address these issues and fortification of an appropriate food source was considered a viable option. Beta-carotene was selected as the food fortification of choice as it is a safe form of Vitamin A in contrast to other forms, which can be potentially toxic in large quantities. A biscuit was chosen as the carrier for the beta-carotene as it was likely to be popular with children, eaten as a snack rather than a replacement for meals, easy to distribute, required no preparation and would have a long shelf life.

After the successful completion of an initial study using a synthetic form of beta-carotene, the NIRU became aware of nutrient-rich Carotino baking fat, which is made from the flesh of red palm fruit – the world's richest natural plant source of carotenes. A new version of the biscuit was developed using Carotino baking fat instead of synthetic beta-carotene and the study was repeated with equally successful results. The other natural characteristics of red palm oil - such as its Vitamin E content - were considered an added bonus and the biscuits were fortified with iron to address another micronutrient deficiency.

The Carotino biscuits were tested on a study group of primary school children who consumed three fortified biscuits for five days per week over three months, alongside a control group who ate non-fortified biscuits. A cold drink prepared with added Vitamin C was served with the biscuits to improve iron absorption.

Not only did the study show an improvement in Vitamin A and iron status of children who ate the fortified biscuits (see diagram 1 below) but it also demonstrated:

- A decrease in the prevalence of iodine deficiency from 97% to 30.2% within six months.
- Improvement in cognitive tests which measured short term memory and attention span.
- A reduction in the number of school days missed as a result of respiratory and diarrhoea-related illnesses.

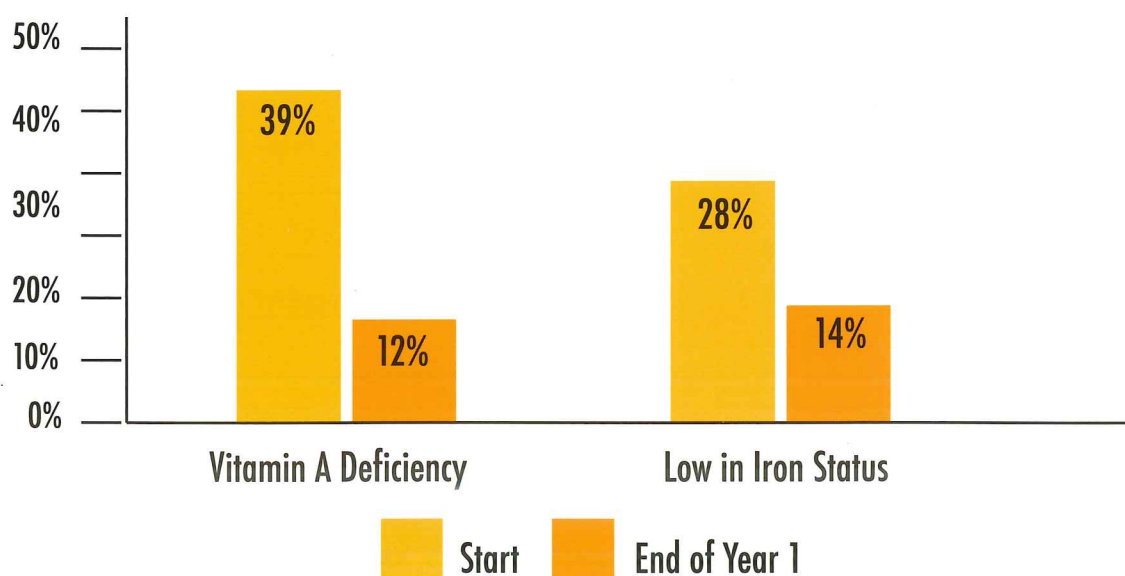


Diagram 1- Prevalence of Vitamin A deficiency and low iron status at the start of the study and after 1 year of consuming three fortified biscuits, five days per week.

International Scientific Research

Extensive scientific research has been carried out on the beneficial effects of supplementing the diets of Vitamin A deficient adults and children with either red palm oil or Carotino-enriched food products. These include the following:

- Mothers in Honduras who consumed Carotino red palm oil showed significant increases in alpha and beta carotene levels in their breast milk and the infants who were breast-fed by these mothers also had significantly higher serum retinal levels.

Canfield L.M. et al., (2000), "Red palm oil in the maternal diet improves the vitamin A status of lactating mothers and their infants", *Food and Nutrition Bulletin*, Vol 21(2): 144-148

- Mothers and children in Burkina Faso whose diets were supplemented with red palm oil showed a 40 % reduction in the prevalence of vitamin A deficiencies.

Zagre N.M. et al., (2002), "Changes in vitamin A intake following the social marketing of red palm oil among children and women in Burkina Faso", *Sante*. 12(1):38-44

- Pre-schoolers in Tamil Nadu, India, whose diets were supplemented with 5-10 ml of red palm oil showed better gains in retinol and beta-carotene levels than children whose diets were supplemented with equivalent amounts of either retinol-fortified groundnut oil or pure groundnut oil.

Sivan Y.S. et al., (2002), "Impact of vitamin A supplementation through different dosages of red palm oil and retinol palmitate on preschool children", *J. Tropical Paediatrics*, Vol 48:24-28

- Pre-school children in Hyderabad, India, who consumed 5ml of red palm oil per day showed marked improvements in their serum beta-carotene levels.

Sivan Y.S., et al. (2001), "Impact of beta-carotene supplementation through red palm oil", *J. Tropical Paediatrics*, Vol 47: 67-72

Contribution of the Carotino Biscuit to the Recommended Dietary Allowance for Vitamin A, Vitamin E and Iron intake of Different Age Groups and in Pregnancy or Lactation

Groups	%RDA* per 45g (3-4 biscuits)		
	Vitamin A	Vitamin E	Iron
Children 4-6 yrs	70	35	50
Children 7-10 yrs	50	25	50
Adults & Children > 10 yrs	44	18	36
Pregnancy/lactation*	29	12	28

*RDA - Recommended Dietary Allowance

- Carotino red palm oil supplementation significantly improved the serum retinal and Hb levels of children under the age of five in rural Vietnam and the Hb levels of the red palm oil supplementation group were as high as those given Vitamin A capsules.

Nguyen T.L. et al., (2001), "Effects of red palm oil supplementation on vitamin A and iron status of rural underfive children in Vietnam", *Proceedings of Food Technology & Nutrition Conference, International Palm Oil Congress 2001, Kuala Lumpur, Malaysia*.

- Bangladeshi children suffering from respiratory infections and other diseases showed significantly increased serum retinol levels after their diets were supplemented with biscuits made with Carotino palm oil.

Ali S.M.K. et al. (2001), "Beta carotene to combat acute respiratory tract infection and diarrhoea disease in slum children of Dhaka, Bangladesh", *Proceedings of Food Technology & Nutrition Conference, International Palm Oil Congress 2001, Kuala Lumpur, Malaysia*





“Carotino baking fat can make a significant contribution towards promoting public health worldwide. It has a great potential for alleviating Vitamin A deficiency in developing countries.”

Prof. AJ SPINLER BENADÉ

(Former Programme Leader, Nutritional Intervention Research Unit, Medical Research Council, South Africa.)

The Advantages of Using Carotino Biscuits

- Carotino biscuits can make an important contribution to the micronutrient intake of at-risk and vulnerable groups, including children, pregnant women, nursing mothers and their infants.
- The health credentials of Carotino oil red palm oil are based on decades of sound scientific research – extensive further information is available on request.
- The biscuits are an excellent source of beta carotenes (pro-Vitamin A), Vitamin E and iron, which are all essential micronutrients.
- Carotenoids and Vitamin E are powerful anti-oxidants which enhance the shelf life of the biscuits without having to add synthetic materials.
- The biscuits have the potential to be carriers for other micronutrients, such as zinc, copper, iodine and B-complex vitamins.
- No harmful trans-fatty acids are present in Carotino biscuits.
- The affordable price of Carotino biscuits makes them ideal for addressing micronutrient deficiencies in developing countries.
- Carotino biscuits are easy to distribute as part of feeding schemes.



About the Carotino Group

Carotino biscuits and Carotino Foods are produced by the Carotino Group, a vertically integrated company which owns and manages in excess of 100,000 acres of oil palm plantations, as well as oil mills and refineries across Malaysia.

The company produces a wide range of palm oil-related products and the Carotino brand is already well established across Asia and is steadily developing its reputation in Europe, Australia, the USA and Africa.

The Carotino Group is a shining example of an ethical palm oil company and its commitment to environmental sustainability, wildlife conservation and the welfare of its workforce is second to none. The company is at the forefront of environmental conservation in the palm industry and it is a member of the Roundtable for Sustainable Palm Oil (RSPO). All its palm products are RSPO-certified, which is a mark of their environmental sustainability.





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