

CHAPTER 1

BACKGROUND AND JUSTIFICATION FOR THE STUDY

1.1 SUBSTANTIATION OF THE STUDY

Retinoids are micro-nutrients that are obtained from the diet as it cannot be synthesised by the body. There are two sources of retinoids in the diet of which the one is provitamin A carotenoids, obtained from plant foods such as dark green leafy vegetables, red palm oil, palm fruits, carrots, orange-fleshed sweet potato (OFSP), mature squashes and pumpkins, mangoes, papayas and some other yellow / orange fruits. The second source is as preformed vitamin A from animal foods i.e. meat and dairy, which are excellent sources of vitamin A (Packer, Obermüller-Jevic, Kraemer & Sies, 2005:2), but economically out of the daily reach of most sub-Saharan African populations. Up to 80 % of the dietary intake of vitamin A in Africa comes from plant foods (Codjia, 2001:358). The best studied provitamin A carotenoid is beta-carotene, which in the body undergoes cleavage to retinal, which is then reduced to two molecules biologically active retinol (Packer *et al.*, 2005:2). Some carotenoids have vitamin A activity and although the absorption and conversion of beta-carotene to retinol are less efficient than retinoids from animal foods, it plays an essential role in the diet (Whitney & Rolfes, 2002:355). Figure 1.1 is a graphic presentation of the conversion of vitamin A compounds.

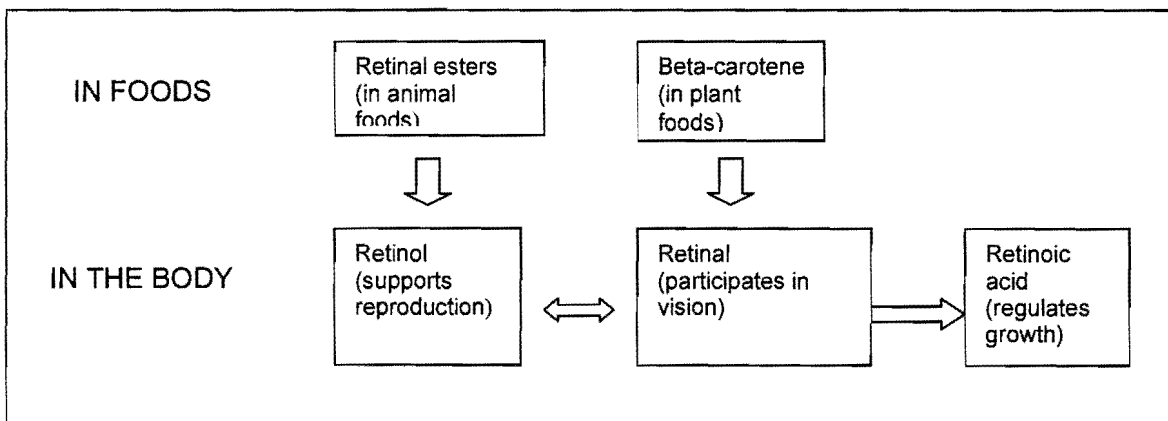


FIGURE 1.1: Conversion of vitamin A compounds (Whitney & Rolfes, 2002:356)

The role of vitamin A in the body is far-reaching and deficiencies can have detrimental effects. Vitamin A promotes vision and a deficiency thereof can lead to night blindness, which is a common condition in developing countries. Beta-carotene participates in protein synthesis and cell differentiation i.e. keeping the epithelial tissues and skin healthy, contributing to the growth of an individual as well as preventing illness due to infectious diseases (Garrow, James & Ralph, 2000: 210; Whitney & Rolfes, 2002:358).

A lack of micronutrients in the diet of many people in developing countries is referred to as 'hidden hunger', which is not as visible as plain lack of food and is a far more serious problem than a lack of energy or a lack of protein (Packer *et al.*, 2005: 275). Worldwide over two billion women and children suffer from micro-nutrient deficiencies in vitamin A, folate, iodine, iron and zinc (Packer *et al.*, 2005:276). In developing countries, infectious diseases are a major problem - killing as many as two million children per year due to related infections such as pneumonia and severe diarrhoea. The risk of dying from diarrhoea, measles and malaria is increased by 20-24% in children with vitamin A deficiency; and the risk from dying from diarrhoea, pneumonia and malaria is increased by 13-21 % in children with zinc deficiency (Black, Morris & Bryce, 2003:2229). Vitamin A supplementation reduces mortality in vitamin A deficient communities (Caulfield, de Onis, Blössner & Black, 2004: 197; Whitney & Rolfes, 2002:358).

Children between the ages of four to eight years require 400 µg vitamin A per day, an adult man 900 µg, adult females 700 µg and lactating mothers 1300 µg (USDA, 1998). The content of provitamin A carotenoids in foods, as well as the bioavailability thereof, are important determinants of the vitamin A status of an individual (Nestel & Nalubola, 2003a:1). Bioavailability refers to the degree to which the nutrient is available after ingestion for normal physiological functions in the body (Nestel & Nalubola, 2003a:1; Faber, Laurie & Venter: 2006:10). Vitamin A activity of 1µg of a provitamin A carotenoid is not equal to 1µg retinol (Nestle & Nalubola: 2003b:1). However, 1 µg retinol is equivalent to 12 µg beta-carotene and 24 µg of other provitamin A carotenoids respectively (USDA 1998). This conversion rate of 1:12 (i.e. 12 mg beta-carotene is equivalent to 1 mg retinol) was confirmed by the US Institute of Medicine (IOM) (Nestel & Nalubola, 2003b:1) as well as by West, Eilander & Van Lieshout, (2003: 2917S). However, it is important to note that the Retinol Activity Equivalent (RAE) conversion factor of 12µg beta-carotene to 1 µg retinol was based on the bioefficacy of carotenoids in a mixed diet eaten by healthy people in developed countries (Van Jaarsveld, Marais,

Harmse, Laurie, Nestel & Rodriguez-Amaya, 2006), and that bioefficacy varies depending on the vitamin A status of the individual. It may be higher in populations from developing countries with vitamin A deficiency, because such people are more efficient in converting provitamin A carotenoids (Nestel & Trumbo, 1999: 26-33).

Vitamin A rich plant foods are more affordable than vitamin A rich animal sources. OFSP has emerged as a promising plant source with a high beta-carotene content that can make a significant contribution to the vitamin A intake of communities at risk of vitamin A deficiency (Low, Walker & Hijmans, 2001:5). This supports the food-based approach as a strategy employed to reduce vitamin A deficiency (Faber, Laurie & Venter, 2006: 14). A half-cup (100 g) serving of the boiled roots can supply up to 136 % (6528 µg / 100 g) of the daily requirements of beta-carotene for young children, whereas white-fleshed sweet potato (WFSP) contributes a mere 0.42 % (20 µg) (Kruger, Sayed, Langenhoven & Holing, 1998:36).

OFSP has been cultivated by the ARC-Roodeplaat as part of an effort to introduce vitamin A-rich vegetables to people in rural areas (Laurie in Niederwieser, 2004:3). Research has focussed on identifying OFSP cultivars that will deliver a satisfactory yield, prove to be pest resistant and with good flavour characteristics. Sweet potato is a hardy crop that has relatively low demands on soil nutrients, while also being more drought tolerant than many other vegetables. It offers flexibility in planting and harvesting times as it has a shorter growing cycle than other root crops, for example the average crop growth period for sweet potato is 140 days and for cassava, 330 days (Laurie & Niederwieser in Niederwieser, 2004:3). Sweet potato plays an important role as a household food security crop in resource-poor farming where sweet potato is grown in home gardens as well as for income (Domola, 2003:49, 50).

One way of ensuring that a new product such as OFSP is correctly introduced into a population or commercial market is to conduct strategic food marketing research which concerns all aspects of the consumer's food related behaviour (Low, Osman & Zano, 2005:1). In addition, the needs of the present and future consumer must be understood in order to identify products with attributes that are desired by the target consumers.

In most sub-Saharan African countries, consumers are familiar with the intrinsic characteristics of WFSP as it is often grown by women and frequently consumed by the

whole family (Van Trijp & Schifferstein, 1994:130). (The intrinsic characteristics refer to the physical and sensory characteristics of a product.)

Ultimately, tapping the potential of OFSP in communities at risk of vitamin A deficiency, hinges on a sustained effort to identify cultivars that are acceptable in colour, taste and texture by different cultural groups. To date, the nutrient content of OFSP grown in South Africa has not yet been determined with the exception of the beta-carotene content on a limited amount of samples. Consumer preference for OFSP over WFSP has not been explored.

From the above mentioned the problem statement for this research study could be formulated as follows: to determining the nutrient content of different cultivars of OFSP, identifying sensory differences in taste and texture for different cultivars OFSP in comparison with WFSP and determining the acceptability of OFSP by consumers of sweet potato. Cultivars that would be acceptable in taste and colour will be identified.

1.2. STRUCTURE AND PRESENTATION OF THE STUDY

From the preceding background and justification, the study will be presented according to the following outline: Chapters 2 and 3 covers a literature overview and research methodology. Chapters 4, 5 and 6 are presented in article format and were submitted individually for publication. For this reason, figures, tables and references are adapted according to the specifications of the specific journal. Therefore, inconsistencies will exist between the different chapters. In chapters 4, 5 and 6 some of the information is repeated, as each chapter is treated as an entity. Furthermore, chapters 5 and 6 are presented as separate articles as not all the same cultivars were evaluated in the two chapters. Therefore, comparisons of the different cultivars would be inadequate if these two chapters are to be combined.

- **CHAPTER 2: SWEET POTATO IN PERSPECTIVE**

Chapter 2 discusses the origin of sweet potato with focus on its uses internationally and locally. It provides a literature overview on the background and justification of the study including the nutritional importance of vitamin A, a brief overview of the quantitative descriptive analysis, consumer sensory research and focus group discussions. It

provides the broad conceptual framework for the study and the concepts relating to the framework are discussed in the chapter.

- **CHAPTER 3: RESEARCH METHODOLOGY**

In chapter 3 the research design is laid out. This was followed by the researcher in order to solve the research problem. It reflects the methods, techniques and procedures that were used in the study.

- **CHAPTER 4: NUTRIENT CONTENT OF ORANGE FLESHED SWEET POTATO**

Chapter 4 is presented in the format of an article and tables, figures and references are presented according to the specifications for the Journal of Food Composition and Analysis, the official publication of INFOODS (International Network of Food Data Systems), a joint project for Food and Agriculture Organisation of the United Nations and the United Nations University. This chapter addresses the nutrient content of OFSP and includes a discussion on the nutrient content of different OFSP cultivars.

- **CHAPTER 5: QUANTITATIVE DESCRIPTIVE SENSORY ANALYSIS OF FIVE DIFFERENT CULTIVARS OF SWEET POTATO**

Chapter 5 is presented in the format of an article and tables, figures and references are presented according to the specifications for the J Sensory Stud. This chapter addresses the sensory analysis of different sweet potato cultivars in terms of aroma, flavour, texture and aftertaste.

- **CHAPTER 6: CONSUMER PREFERENCES FOR SWEET POTATO**

Chapter 6 is presented in the format of an article and tables, figures and references are presented according to the specifications for Development Southern Africa. This chapter addresses the preference tests with consumers in order to establish consumer acceptability of OFSP.

- **CHAPTER 7: CONCLUSIONS AND RECOMMENDATIONS**

In chapter 7 the main findings and recommendations for the study are presented according to the conceptual framework compiled for this research study.

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