

# CHAPTER 7

## CONCLUSIONS AND RECOMMENDATIONS

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### 7.1 INTRODUCTION

OFSP is a new exciting root vegetable in South Africa that is rich in beta-carotene, has an orange colour and is tasty. The main findings of the study are presented according to the three aims of the research project. This study firstly aimed to examine the nutrient content of orange fleshed sweet potato (OFSP) in South Africa, by analysing four different cultivars OFSP and one composite sample. The second aim was to establish the sensory characteristics of OFSP by developing sensory profiles for four OFSP cultivars and one white-fleshed sweet potato (WFSP) cultivar by making use of a trained sensory panel. The third aim of the study was to determine consumer acceptability of OFSP with 182 consumers of different socio-economic levels living in Pretoria (Tswane Metropolitan area). The conclusion and recommendations of the study will follow after the main findings. All three aims were addressed and achieved.

### 7.2 MAIN FINDINGS

The main findings are discussed according to the research questions presented in chapter 3.

#### **Nutrient content of OFSP**

1. What is the nutrient content of raw and cooked OFSP?

Different cultivars OFSP were analysed for their nutrient content with regard to macro-nutrient and micro-nutrient content. A 100 g portion of cooked OFSP can provide up to 6528 µg beta-carotene, which is approximately 136 % of the RDA for vitamin A for children four to eight years. OFSP is also a valuable source of vitamin C, calcium,

magnesium and zinc. A 100 g cooked OFSP can contribute up to 28 % of the vitamin C requirements of a child between the ages of four to eight years per day. It further contributes up to 13 % of the daily requirements for calcium, 15 % magnesium and 75.6 % zinc.

### **Nutrient differences between cultivars**

1. Is there a difference in the nutrient content of different cultivars (Resisto, W119, Jewel and A15) cooked OFSP?

Differences were found in the nutrient content of the different cultivars, especially with reference to the dry matter (DM), beta-carotene and calcium content. The DM content differed between the different cultivars. It was observed that cultivars with a higher DM content had somewhat higher nutrient content values, for example, the Resisto cultivar had a DM content of 23.08 g / 100 g (highest) and W119 a DM content of 16.76 g / 100 g (lowest). Breeding programmes often screen new crops for high DM content, as a high DM is associated with higher yields in terms of energy per area. A high DM in potatoes is assumed to give a floury texture (Van Oirschot, Rees and Aked, 2003:679), which was not the case with sweet potato, as the Resisto cultivar, which had a high DM content and a low moisture content, was not described as having a floury texture. The Resisto cultivar also had the highest calcium, phosphorus and beta-carotene content. Although differences were found in the beta-carotene content of the different OFSP cultivars, it remains an excellent source of beta-carotene, while WFSP is almost void of beta-carotene.

### **Sensory analysis of different sweet potato cultivars**

3. How does the descriptive sensory characteristics of Beauregard, Kano, W119, Resisto OFSP cultivars and Blesbok WFSP cultivar compare with each other?

The sensory profiles of the different sweet potato cultivars showed that the OFSP differed from WFSP in that it had a more intense earthy aroma and a less intense sweet potato aroma. OFSP overall was sweeter and had characteristics similar to that of yellow-vegetables such as butternut, pumpkin and carrots. The texture of OFSP was less moist and less fibrous than WFSP. OFSP displayed a more dense and pasty texture, which was most intense in the Resisto cultivar. W119 had more grainy texture when compared to the

other OFSP cultivars tested. The firm appearance of OFSP sweet potatoes also varied between the different OFSP cultivars and Beauregard and Kano had the most firm appearance. Although the orange colour of the different cultivars was not measured, colour differences were observed and the Resisto cultivar had the darkest orange colour.

The PCA showed that in PC1, the Resisto and W119 cultivars OFSP contrasted with the Blesbok cultivar WFSP the strongest. Resisto was mostly associated with the sweet and yellow vegetable flavour attributes, intense adhesiveness / pasty and low moisture texture attributes; whereas Blesbok cultivar WFSP was mostly associated with the typical sweet potato flavour attributes as well as the moist texture attributes. In PC 2, Resisto contrasted with W119 the strongest. W119 cultivar OFSP was mostly associated with firm and grainy texture attributes which scored lower values in Resisto cultivar OFSP.

### **Consumer preference test**

4. Is there a difference in the taste preference for Resisto cultivar OFSP compared to Blesbok WFSP cultivar by urban adult consumers from different socio-economic groups, living in the greater Pretoria (*Tshwane Metropolitan*) area

The results from the consumer acceptability test showed a preference for OFSP. Overall 85 % of the respondents preferred the taste of OFSP, 53 % liked the orange colour a lot while 24 % liked the colour a little and the remainder 22 % displayed a negative attitude towards the orange colour. Furthermore, 86% of the respondents indicated a willingness to purchase OFSP.

The focus group discussions, which were only included in the study to verify the results obtained from the consumer test, also showed that respondents preferred OFSP and it was further revealed that sweet potato is consumed differently by different cultural groups. However, after providing information regarding the health benefits of the beta-carotene present in OFSP, respondents showed a greater interest in OFSP and a willingness to purchase it.

### **7.3 CONCLUSIONS**

In this study, each specific research area, as presented in the conceptual framework in Chapter 3, provided different insights with regard to the role of OFSP in the diet. OFSP

contributes a variety of nutrients that are essential for everybody but specifically for people who suffer from malnutrition. OFSP can become one of the most important sources of vitamin A in rural communities, where vegetable gardens are developed. A newly created awareness within communities about the health benefits of consuming beta-carotene rich fruits and vegetables will not only introduce variety in the diet, but result in a significant increase in vitamin A intake and subsequently reduce vitamin A deficiency. In addition, the production of OFSP has the potential for income generation and therefore social upliftment of these households and, in the long term, the community as a whole (Faber, Phungula, Venter, Dhansay, Benade, 2002:1050).

The quantitative descriptive analysis measured significant differences between different cultivars with respect to a range of sensory descriptors including textural and flavour components. The main differences were found in the sweet flavour and texture attributes. New emerging cultivars can be profiled using the lexicon that was developed in this study to identify textural and taste differences among different cultivars. In addition, these findings have important implications for overall consumer acceptability of the different cultivars and can be used in future studies to profile new emerging cultivars

The results of the consumer tests revealed readily acceptance of the taste and colour of OFSP when compared to WFSP by both female and male respondents. Overall 83% of the males and 87% of the females who participated in the study preferred OFSP to WFSP. The information generated from the focus group interviews agreed with the findings of the consumer questionnaire and the knowledge that OFSP was more nutritious than WFSP, had a positive effect on the acceptability of OFSP. Therefore, OFSP has the potential to be successful in the marketplace.

#### **7.4 LIMITATIONS OF THE STUDY**

Shortcomings of the present study, with regard to the nutrient analysis of sweet potato, were that limited samples of each cultivar from the different regions were available for nutrient analysis. Although comparing the nutrient content of cultivars from different regions, was not an aim of the study, the limited available sample restricted the interpretation of the results. Cultivation procedures have an effect on the sweet potato character during the sweet potato root-shaping period (Chun-Sheng, 1985:1; Laurie in Niederwieser, 2004:3). Comparing such effects could provide insights on cultivation procedures for optimum yield.

Secondly, the consumer test could have provided more insights into taste and textural preferences of different OFSP cultivars by including more cultivars in this test. During the focus group discussions, more information with regard to cultural preferences for sweet potato as well as preparation methods could have been obtained, plus uses of OFSP and whether OFSP would be treated that same way as WFSP or similar to pumpkin or butternut.

## 7.5 RECOMMENDATIONS

OFSP can be regarded as a nutritious food product that could be easy to grow, is pest resistant and some cultivars deliver adequate yields in selected regions. The data on the nutrient content of OFSP, now available from the present study, can provide a valuable guideline for nutritionists who are involved in community health to calculate adequate nutrient intakes. The following are recommendations for future studies:

- From the sensory profiles of OFSP and WFSP, it was observed that differences were found mostly in sweetness and texture. As the texture of different cultivars plays an important role in the taste acceptability of root vegetables such as potatoes and sweet potatoes, it is recommended that more cultivars are evaluated for their textural qualities.
- The sensory profiles of cultivars that deliver a good yield are pest resistant and that show potential for introduction to farmers and secondary nurseries, should be analysed at different stages of the shelf-life under different storage conditions.
- Consumer preference impacts upon the acceptance of new sweet potato crops released by breeding programmes. Benefits such as superior yield and improved disease resistance may not override unacceptable sensory factors (Van Oirschot, Rees & Aked, 2003:679). The variation in preferences between consumer groups and the use of sensory evaluation in crop breeding programmes is very valuable. This approach provides invaluable information about potential rejects and the reason for the rejection of new crops. Although according to Laurie (in Niederwieser, 2004:57), cultivars with a high dry matter content of > 30% are preferred by the South African consumer, it is culture specific. Villareal, Tsou, Lai and Chiu (1979:32) found that the acceptance of sweet potatoes was ranked according to the nationality of the panel member and suggested that the eating quality of sweet potato roots should be

evaluated in the specific country where the selected cultivar will be introduced for adoption. The acceptability of textural differences that exist between promising cultivars should be tested with consumers in the different regions where OFSP are cultivated in order to identify cultural differences with regard to the texture of sweet potatoes.

- The 'willingness to buy' needs to be tested with actual prices for the different products that are available at different outlets e.g. retailers or street vendors. The consumer questionnaire only asked whether consumers would be willing to buy OFSP and no price structure was provided. It is further recommended that a more representative sampling approach is followed with a consumer study that would be representative of the whole of South Africa. Such a study would be able to measure frequency of purchase of sweet potato, consumption thereof as well as establishing where OFSP could fit into the daily diet.
- The key constraint in introducing a new variety is the availability of adequate amounts of planting material (Low, Osman and Zano, 2005:1,2). In order to convince producers and consumers to accept something to which they are not accustomed such as OFSP, creating of a demand and awareness is an integral part of the variety introduction strategy (Low *et al.*, 2005:1). Communities can be made aware of OFSP through promotional messages through radio programmes, hats and T-shirts that carry the message of OFSP and vitamin A.
- Behaviours regarding child feeding practices and diversification of household diet, should be addressed by nutritionists or agricultural extension officers in communities at risk of vitamin A deficiency. Households should be encouraged to produce a surplus of sweet potato so that there is sufficient for home consumption and for selling purposes.

## **7.6 THOUGHTS TO TAKE HOME: SWEET POTATO FROM A MARKETING PERSPECTIVE**

Many different sweet potato cultivars are found in the world and cultivar preferences and requirements also differ among people in the world. In South Africa, promising cultivars for the delivery of carotenoids to alleviate vitamin A deficiency are evaluated in trials at target sites, after which recommendations are made, based on adaptability and, at a later stage, taste acceptability by the particular community. Once a cultivar has been

identified as suitable for a certain region, stock plants from the virus-tested glass house collection of the ARC are established in nurseries in the target areas. Cuttings of the new cultivars are distributed from the primary nurseries to secondary nurseries as well as to resource poor farmers, where training is conducted in the cultivation and multiplication of sweet potato (Laurie in Niederwieser: 2004:59-62).

In addition, the South African Food Based Dietary Guidelines (FBDG) Work Group was mandated in 1997 to develop new guidelines for South Africa. A final set of FBDG for healthy South Africans, seven years and older, were approved and adopted as national guidelines for South Africa by the National Department of Health, on 9/05/2003 (Marais, 2006:S17). One of these guidelines is: 'Eat plenty of vegetable and fruit every day' and is motivated by reviewing the evidence that these foods contribute valuable nutrients to the diet. Although OFSP is relatively unknown, it will gain popularity due to its vitamin A content and contribution to various other nutrients such as vitamin C, calcium and zinc as should be strongly promoted for home-based vegetable gardens as part of the National Health strategy of the Department of Health and home-based vegetable gardens of the Department of Agriculture.

An important function of marketing is to understand the present and future needs of potential customers for a certain product and to use such information to identify new products or product concepts with optimum attributes that are desired by the target consumer (Zigmund & d'Amico, 2002:43). The taste of a product primarily determines its acceptance by consumers. If a product does not deliver on taste, regardless of the health benefits, its future success cannot be guaranteed. It is therefore important to position the product correctly in the market place.

When introducing a product into the market place, there are five stages in the process from primary production to consumption of food products that should be taken into consideration when planning to launch a new product such as a new variety of vegetable (Van Trjip and Schifferstein, 1994:130). These include the following:

- Ingredients or product (stage 1): Although OFSP is a new cultivar that is still relatively unknown in South Africa, it is an extension of a range of an existing product / vegetable variety i.e. white-fleshed sweet potatoes. The product is therefore not completely new to consumers, and acceptance could be more ready as consumers may be willing to try it as an alternative to WFSP, especially if its appearance is not completely foreign.

- Intrinsic product characteristics (stage 2): This refers to the physical, chemical and microbiological analyses as well as the sensory analyses plus the extrinsic product characteristics. The descriptive sensory evaluation of OFSP found it to be a sweeter vegetable than WFSP. The nutritional analysis found that OFSP is rich in beta-carotene plus it makes a significant contribution to the energy intake of children between the ages of four to eight years (4.5% / 100g portion). In addition, a 100g cooked portion (half cup) further provides up 28 % vitamin C, 13 % calcium, 15 % magnesium as well as 7 % iron and 75.6 % zinc to the diet of this age group.
- Attitude and perception (stage 3) of the consumer towards the new product and consumer preference (stage 4). The consumer evaluation indicated an overwhelming acceptance of the taste and colour of Resisto cultivar OFSP. However, the negative perceptions that emerged from the focus group interviews that the dark orange colour of Resisto OFSP could be due to genetic modification is a concern that should be taken cognisance of when marketing and educating OFSP to the consumer. Although genetic engineering (GM) in the field of food production is both beneficial and advantageous, public concerns about the safety of consumption as well as environmental concerns are steadily increasing (Arvanitoyannis and Krystallis, 2005: 343).
- Choice (stage 5) of the product. Price influences food choice. Economic conditions largely dictate how households allocate their food budget. It was found that consumers are more likely to adjust purchases to price changes within a major food group than to those between major food groups (Smallwood, Blaylock and Zeller, 1981: 75). In the present study, 86 % of the participants indicated that they would be willing to buy OFSP. However, willingness to buy a product is a complex issue and is influenced by many factors such as income, size of the family, cultural background and education (Smallwood *et al.*, 1981:75), and cannot be determined by asking consumers only one question that related to this issue. Although the intrinsic and extrinsic characteristics as well as consumer perception and preference were tested, the 'product choice' needs to be addressed with the introduction of OFSP into the marketplace.



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