

CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

Following on the background information, aims and motivation of the study in Chapter 2, this chapter provides an overview of the research methodology followed in this study.

3.2 RESEARCH DESIGN

This research was of an explorative nature, therefore an open and flexible research strategy was applied and methods that lead to insights and comprehension were used (Babbie & Mouton, 2001:270). A quantitative research approach was followed to measure the sensory characteristics (aroma, flavour, texture and aftertaste) of sweet potatoes, acceptability of OFSP by consumers from different socio-economic groups and to measure the nutrient content of OFSP. A qualitative research technique i.e. focus group interviews, was applied in order to provide supportive information and validate findings of the consumer research through triangulation.

3.3 AIM OF THE STUDY

Broadly, this research study aimed to investigate the nutrient content and sensory characteristics of OFSP. Firstly, the study aimed to evaluate the nutrient content of different cultivars of OFSP. The findings were compared with existing data from Food Composition Tables of the Medical Research Council (Kruger, Sayed, Langenhoven & Holing, 1998) and the USDA Food Composition Tables (8th version, 1998) on the nutrient content of WFSP and carrots in order to establish the position of OFSP in alleviating vitamin A deficiency in South Africa. Secondly, the study aimed to determine and compare the sensory characteristics of different OFSP cultivars and WFSP. The final

aim was to subsequently determine the acceptability of the taste of OFSP among urban adult women and men of different socio-economic groups. From this broad aim, the following research questions were formulated.

3.3.1 Research questions

The main research question for this study was formulated as follows:

What is the nutrient and sensory quality of different cultivars OFSP as produced in South Africa?

This leads to the formulation of the sub-questions for the study

1. What is the nutrient content of raw and cooked OFSP?
2. Is there a difference in the nutrient content of different cultivars (Resisto, W119, Jewel and A15) cooked OFSP?
3. How does the descriptive sensory characteristics of Beauregard, Kano, W119, Resisto OFSP cultivars and Blesbok WFSP cultivar compare with each other?
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?

3.4 CONCEPTUAL FRAMEWORK

The broad conceptual framework for this research study on the sensory and nutrient content of sweet potato is presented in Figure 3.1.

The conceptual framework indicates the steps followed during the process of data collection to answer the research questions of this study. The design broadly outlines the steps and methods that were followed throughout the study.

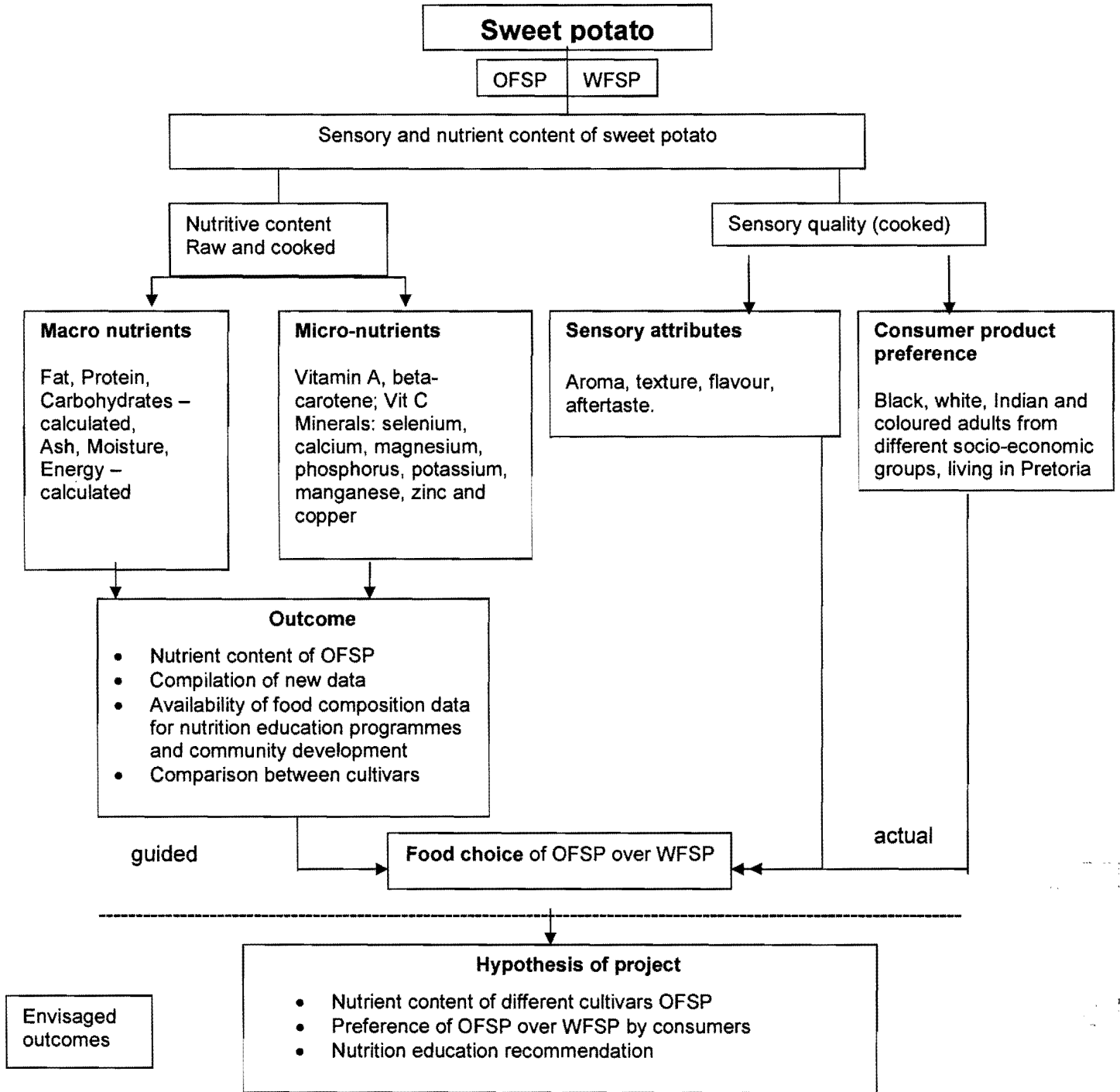


FIGURE 3.1: BROAD CONCEPTUAL FRAMEWORK

3.4.1 Conceptualisation

Nutrient analysis refers to the measurement of the nutrients within a food such as protein (N), moisture, fat, carbohydrates by difference, as well as mineral and vitamins (Greenfield & Southgate, 2003:97-99). The macro-nutrients measured in this study were the protein and fat. The carbohydrate content and energy values were calculated. The micro-nutrients (vitamins and minerals) analysed were the beta-carotene and vitamin C, selenium, calcium, magnesium, phosphorus, potassium, iron, manganese, zinc and copper content. The moisture and ash contents were also determined.

Chemical composition of the samples refers to the percentage water (moisture), fat, protein, (protein nitrogen (N) x conversion factor of x 6,25 = % protein) and ash (minerals) present in the OFSP cultivars. It was determined according to AOAC methods (2005) in a South African National Accreditation Services (SANAS) laboratory (the chemical analysis was performed on raw and cooked OFSP samples).

Descriptive sensory analysis refers to a series of sensory tests whereby a trained sensory panel rates specific attributes or intrinsic characteristics of a product on a scale of perceived intensities (Lawless & Heymann, 1998:806). An 8- point category rating scale was used in this project.

Consumer food acceptability refers to the consumption of food accompanied by pleasure. Therefore, food acceptance comprises a behavioural and attitudinal component (Randall & Sanjur, 1981:151). The behavioural component refers to the individual's attitude towards, for example, the taste of a product (Conner, 1993:28).

Food preference refers to an expressed choice between two or more food items. Food preference techniques are used when the researcher wishes to measure the preference of one product directly against another product (Lawless & Heymann, 1998:430).

Food choice refers to the set of conscious and unconscious decisions made by a person at the point of purchase or at the point of consumption (Hamilton, McIlveen & Strugnell 2000:113). Attitudes towards food choice can also be influenced by the knowledge about a food product which could affect the attitude which in turn could affect the behaviour related to the choice of food (Shepherd & Sparks in MacFie and Thomson,

1994:206). The consumer preference in this study was determined by making use of a 5-pt hedonic rating scale to measure consumer liking of OFSP and WFSP.

3.5 UNIT OF ANALYSIS

Sweet potato

Different cultivars of sweet potato were used as the unit of analysis of the nutrient content of sweet potatoes, the descriptive sensory evaluation and consumer acceptability tests.

Trained sensory panel

An experienced sensory panel consisting of 12 trained panel members was used to perform the descriptive sensory analysis of OFSP and WFSP in order to develop a flavour profile for each.

Consumer evaluation

The unit of analysis was black, white, coloured and Indian female and male adults from different socio-economic groups, who consume sweet potato and live in the greater Pretoria*(Tshwane Metropolitan) area.

** Pretoria is part of the City of Tshwane which is 3200² km in size; population of 2.2 million; situated in the province of Gauteng, South Africa.*

3.6 MEASUREMENT PROTOCOL AND OPERATIONALISATION

Nutrient analysis

The ARC-Irene Analytical laboratory conducted the proximate analysis of four different cultivars i.e. Resisto, W119, Jewel, A15 plus one composite sample raw and cooked OFSP. (ARC- Irene Analytical Services is a South African National Accreditation Services (SANAS), accredited laboratory). The beta-carotene content of the four different OFSP cultivars was analysed by the Nutritional Intervention Research Unit of the Medical Research Council in Tygerberg. The mineral analysis was conducted by the

ARC-Institute for Soil, Climate and Water. Standardised analytical techniques were used for the analysis. The nutrient content of OFSP was compared with the nutrient content of WFSP and carrots. The nutrient contribution of OFSP to the Recommended Dietary Allowance (RDA) for children between the ages of four to eight years will be discussed (USDA, 1998)

Descriptive sensory analysis of sweet potato

Descriptors and definitions of the sensory characteristics of Resisto, Kano, W119 and Beauregard cultivars OFSP and Blesbok cultivar WFSP were developed and applied to measure the intensity of each sensory attribute in the different cultivars on an eight-point category rating scale. Experienced panellists were trained on the different types of sweet potatoes for four days (two hours per day), prior to being evaluated in individual sensory booths on four consecutive days. Sweet potato samples were evaluated under red light conditions in order to mask the colour difference that is characteristic of the different cultivars. One session per product was conducted per day in order to obtain four repetitions over four days which will provide statistically reliable results (Lea, Næs & Rødbotten, 1998:58).

Physical texture analysis

Physical texture analysis with the Instron Universal Testing Machine was performed on all sweet potato samples. After cooking, samples were cooled down at room temperature for at least 2-hours before shear force measurements. Cylindrical samples with a 12.5 mm core diameter were cored and sheared perpendicular to the fibre direction using a Warner Bratzler shear device mounted on a Universal Instron apparatus (6-8 cores / sample). The reported value in kg represents the average of the peak force measurements of each sample.

Consumer acceptability of Resisto cultivar OFSP vs. Blesbok cultivar WFSP

The first step in testing the consumer acceptability was to use the attributes of Resisto cultivar OFSP and Blesbok cultivar WFSP that were identified during the descriptive sensory analysis, to design a paired preference test in order to compare preference for OFSP (Resisto) to WFSP (Blesbok) on colour and taste. The outcomes of the consumer acceptability test were verified by conducting three focus group discussions with consumers from different socio-economic groups.

3.7 POPULATION AND SAMPLING

During this study, Resisto, Jewel, W119 and A15 OFSP cultivars were analysed for their nutrient content. The cultivars analysed for nutrient content differed from the cultivars included in the sensory evaluation due to the limited availability of different cultivars from different regions for nutritional analysis. Resisto, Kano, W119 and Beauregard OFSP cultivars and Blesbok WFSP cultivar were used as the unit of analysis for the quantitative descriptive analysis. The sensory evaluation required samples that were harvested from the same region on the same day in order to eliminate unnecessary variables that would influence the results. Resisto cultivar OFSP and Blesbok cultivar WFSP were used for the consumer evaluation.

Nutrient analysis

According to practicality and availability, four different cultivars plus one composite sample of OFSP were sampled from three different regions in South Africa. Sound sampling methods were applied, although in some cases the researcher did not have full control over the sampling methods and had to rely on the discretion of helpers in regions such as the Free State and Eastern Cape. However, all the samples were harvested at the end of the growing season, approximately four to five months after planting. Once harvested, samples were kept in basket-weave bags and stored in a cool room. Samples were prepared for nutrient analysis at the sensory laboratory of the ARC-Irene within five days after harvesting to be representative of commercial practice. All preparation procedures were monitored and recorded. Samples were weighed before and after preparation. Approximately 1.5 kg raw and cooked product per cultivar was prepared for analysis and each cultivar was treated separately. The raw and cooked samples were taken from different roots, as cutting the roots would have caused leaching of nutrients during cooking of samples. Table 3.1 presents the sampling plan and shows the number of units per cultivar from the different regions.

TABLE 3.1: Sampling plan to show the units per cultivar from the different regions

CULTIVAR	REGIONS	UNITS
Resisto	Gauteng, University of Pretoria vegetable gardens	30 units
W119	Gauteng, University of Pretoria vegetable gardens	20 units
Jewel	Gauteng, University of Pretoria vegetable gardens	20 units
	Free State, Fouriesburg	5 units
A15	Free State, Fouriesburg	5 units
Composite sample of 3 cultivars	Eastern Cape	5 units

Cooked samples were boiled in their skin in stainless steel saucepans with the lid on and 500 ml water was added to the saucepan and it was brought to boiling point at 95 °C. Water was replenished if required. Sweet potatoes were cooked until soft, which took approximately 40 min for a 250 – 300 g per sample. The sample size influenced the length of cooking time but, when the core temperature reached approximately 94 °C, the sweet potatoes were soft, which was tested by inserting a stainless steel probe. Samples were then cooled to room temperature and peeled (skin was easy to peel off / remove from cooked samples). The flesh was mashed with a fork, thoroughly mixed and 1 kg samples were packed in plastic bags and sealed. Samples were coded and dispatched on the same day to the analytical laboratory for freeze-drying, after which they were ground and then stored at -20 °C.

Approximately 1.5 kg raw OFSP of each cultivar was prepared by firstly weighing the raw samples, peeling and grating – using a stainless steel grater. Samples were grated medium to rough, by hand (approx 1 mm x 2 mm). Grated samples were thoroughly mixed and packed as 1 kg samples in plastic bags and sealed. Each sample was clearly coded and dispatched to the analytical laboratory for analyses, where the samples were freeze-dried and then stored at -20 °C.

Quantitative Descriptive Analysis

Twelve individuals previously trained in sensory analysis, were used to describe the complete profile of the sweet potatoes. Panel members were selected on their ability to provide similar responses to similar products on repeated occasions. The closer their responses were, the higher the degree of reliability, which gave confidence in the validity of the results. Panellists were also chosen for their smell acuity and interest in the project as well as being available for the entire study. This was followed by evaluation of the products in terms of its aroma, texture on appearance, texture on first bite, texture on mastication, flavour and aftertaste attributes. .

Consumer evaluation

The target population for this study was black, white, coloured and Indian female and male adults aged 20-60 years who consume sweet potato and lived in the greater Pretoria* area, in the proximity of Centurion. Income of the household, as an indicator of different socio-economic groups of consumers, was used to screen respondents. A household refers to a group of people living together and providing themselves jointly with food and / or other essentials for living (Census 2001: Census in brief / Statistics South Africa, 2003:vi). As mostly women produce and / or purchase sweet potato (Domola, 2003:49), 60 % of the sample consisted of women and 40 % of men. Women are decision makers regarding food choice for the household. Men were included in the study as they form part of a family and therefore play an important role in the acceptance and ultimate utilisation of the OFSP at household level.

Table 3.2 provides details of the total population of South Africa and Gauteng. Groups were selected based on the population criteria. As lower socio-economic groups are more likely to suffer from vitamin A deficiency, more respondents of lower socio economic backgrounds were included in the study.

TABLE 3:2: SAMPLING PLAN FOR THE CONSUMERS THAT PARTICIPATED IN THE STUDY (REFER GREYED AREA). (Census 2001: Census in brief / Statistics South Africa, 2003:6,7,8)

Population groups included in the study	Population of South Africa			Number of respondents for study			Actual % of each population group included in the study
	Total population in South Africa 44,8M	Total population Gauteng 8,8M	Total population Gauteng %	Total number of respondents included in the study	Female	Male	
Black	35.4	6 522 792	74	144	88	56	79
Coloured	3.98	337 974	3.7	2	1	1	1.1
Indian	1.12	218 015	2.2	2	1	1	1.1
White	4.3	1 758 398	20	34	33	1	19
Total				n =182	n = 123 (68 %)	n = 59 (32 %)	

The respondents were recruited from various farms, institutions and companies and included cleaners, farm-workers and management. At farms, the farm manager was contacted in advance and arrangements were made to conduct the research with the relevant farm workers. The farmer identified workers who were able to participate and any worker who consumed sweet potatoes was allowed to participate, including literate and illiterate workers. At offices, the researcher made contact with the relevant supervisor and arranged for a suitable time to conduct the research. All the requirements with regard to the research i.e. evaluation forms, cooked samples and serving utensils were transported to the research venue. Snowball sampling was applied which refers to the procedure where the target respondent indicates members of that population (friend, relatives, colleagues) as another possible participant (Babbie & Mouton, 2001:167). According to Jellinek (1985:28) in a hedonic test, 30-50 persons should participate. This study included 182 subjects as it was conducted over different population groups i.e. 123 females and 59 males (refer to table 3.1).

Table 3:3 summarises the selection criteria for the consumer acceptance testing.

TABLE 3:3: SELECTION CRITERIA FOR CONSUMERS

CRITERIA	MOTIVATION
<ul style="list-style-type: none"> Ethnicity and gender 	<p>Sweet potatoes in rural areas are primarily produced by women on the land given to them by their husbands. Husbands have some say in what is eaten by the members of the household and therefore should be included in the study.</p> <p>Sweet potatoes are consumed in rural and urban communities. urban white, black, coloured and Indian respondents were included in the study.</p>
<ul style="list-style-type: none"> Age Adults (aged between 20-65 years) 	<p>Women are the gatekeepers of the family and usually purchase food for the family. Sweet potatoes are consumed by all age groups, but adults are more likely to do the purchasing.</p>
<ul style="list-style-type: none"> Sweet potato consumption 	<p>Consumers must be users of sweet potatoes.</p>

Focus group discussion

A few focus group discussions were conducted and were only included to verify some of the findings of the consumer research. The target population for the focus group discussions was the same as for the consumer evaluation. Only three focus group discussions were conducted for the purposes of triangulation with results obtained in the consumer evaluation. With this qualitative technique, information was gathered that would otherwise not have been accessible such as preparation methods particular to a community or beliefs about the benefits of sweet potato by a specific community (Babbie & Mouton, 2001:292). Each focus group consisted of ten-twelve respondents from different socio-economic groups. Two of the focus groups were conducted with consumer groups (delegates) that were involved in a separate training course at the ARC-Irene. As these delegates fell within the target group for this study, the researcher arranged a suitable time to conduct the focus group discussions. This was a practical way to recruit respondents to participate in the preference test as well as the focus group discussion as the researcher was based at the ARC-Irene. The third focus group was conducted with white females that were recruited with the help of the trained sensory panel of the ARC-Irene. Each panel member recruited one friend who consumed sweet potato. However, panel members who were part of the descriptive analysis were not permitted to participate in the focus group discussion. The individuals were not evenly distributed.

3.8 DATA ANALYSIS

3.8.1 Nutrient analysis of OFSP

Methods of analysis

Various laboratories were tasked to analyse the nutrients present in OFSP. Table 3.4 summarises the analytical methods applied for nutrient analysis and lists the different laboratories used.

Table 3.4: SUMMARY OF THE ANALYTICAL METHODS USED FOR NUTRIENT ANALYSIS

Analysis	Method / technique	Institution / laboratory
Proximate analysis	AOAC 2005	ARC- Irene Analytical Services, South African National Accreditation Services (SANAS), accredited laboratory
Carbohydrates	Calculated 'by difference'	
Food energy content	Calculated	
Water soluble vitamins		ARC- Irene Analytical Services, SANAS accredited laboratory
Vitamin C	Liquid chromatograph	
Fat soluble vitamins		Nutritional Intervention research Unit of the Medical Research Council (MRC), Tygerberg
Beta Carotene	HPLC	
Minerals	ICP- emission spectrometer	ARC-Institute for Soil, Climate and Water

The results of the nutrient analysis of the different cultivars were entered on a spreadsheet using Microsoft Excel (2003). Data was statistically analysed by the ARC, Biometry Unit using GenStat for Windows (2003) statistical programme. A limited amount of data was available i.e. only 15 values which included 5 cultivars (W119, Jewel, Resisto, A15 and a Composite sample), three regions (Free-state, Eastern Cape and Gauteng) and two treatments (raw and cooked). Analysis of an unbalanced design using Genstat regression was applied.

The first regression analysis was applied to the overall raw and cooked values of all the OFSP cultivars. The tests that followed used the raw and cooked values for each cultivar as repetitions and the main effect of each sample was then tested separately for

cultivar and then region at a 5 % level of significance. If the sample main effect was significant, Fishers' protected t-test least significant difference (LSD)-test was applied to separate the sample means.

3.8.2 Quantitative descriptive analysis

Data obtained with Quantitative Descriptive Analysis (QDA) procedure was analysed by applying analysis of variance (ANOVA) statistical procedure, which was followed by multivariate statistical techniques i.e. correlation analysis and principal component analysis. All statistical analyses were done using GenStat for Windows (2003) statistical computer programme.

Analysis of Variance

Analysis of Variance (ANOVA) is one of the most common statistical procedures performed in descriptive analysis where more than two products are compared, using scaled responses (Lawless & Heymann, 1998: 701). ANOVA tests the hypothesis in so-called linear models which are based on comparing two variance estimates with each other (Lea *et al.*, 1998:23). It provides a sensitive tool for measuring whether variable treatments such as changes in processing, production or packaging have an effect on the sensory properties of the products. It examines variation between treatments, relative to variation within treatments. To achieve reliable results, a good experimental design, careful control and good testing practices are of utmost importance. ANOVA addresses multiple treatments to compare several means at one time and estimates the variance or squared deviation attributable to each factor, while also estimating the variance or squared deviation due to error. In ANOVA, a ratio of the factor variance is constructed to the error variance. This ratio follows the distribution of the F-statistic. If the F-ratio is significant for a given factor, it implies that at least one of the individual comparisons among means is significant for that factor. In other words, the F-ratio is a signal to noise (Lawless & Heymann, 1998: 701-3).

In this study, the different treatments referred to the five different cultivars i.e. Resisto, Kano, W119 and Beauregard OFSP cultivars and Blesbok WFSP cultivar.

Multivariate Analysis

Multivariate statistical methods refer to a method that is applied to data sets that contain both dependent and independent variables i.e. data sets in which one or more of the variables are special or of more interest relative to some others (Meilgaard, Civille & Carr, 1991: 276). The aim of multivariate statistical analysis is to extract information from a product attribute matrix and to present it in an understandable form. The sensory specialist is then able to detect broader patterns of interrelationships among products and among sensory characteristics than given by a univariate analysis (Lawless & Heymann, 1998: 586).

Correlation analysis

This is one of the simplest multivariate techniques and measures the strength of linear relationships between two variables. It can be used to identify groups of responses that vary in similar ways. The correlations indicate that an increase in a specific attribute will result in an increase in a correlating attribute e.g. flavour and aroma, or *visa versa*. Correlation analysis can also be used to determine the strength of the relationship of data arising from two different sources, for example consumer ratings and descriptive data from a trained panel. The strength of the relationship between two attributes is expressed in the correlation coefficient (r) (Meilgaard *et al.*, 1991:276).

Principal component analysis

Principal Component Analysis (PCA), a multivariate statistical technique, was applied to the data in order to identify the main variates that explained the data and, therefore, simplified the interpretation of the descriptive sensory data. The purpose of the PCA is to transform the set of original correlated descriptors into a new set of principal components, which are linear combinations that explain the greatest amount of observed variability in the data. It is possible to explain 75 – 90 % of the total variability in a data set containing 25 – 30 variables with as few as two to three principal components. PCA is a dimension-reducing technique, therefore descriptors are ranked so that the variation in the data-set explained by the successive principal components decreases (Van Marle, Van der Vuurst De Vries, Wilkinson & Yuksel, 1997: 82). Through PCA, the correlation structure of a group of multivariate observations is analysed and the axis along which maximum variability of the data occurs is identified and referred to as the first principal

component or PC1 (horizontal axis). The second principal component or PC2 (vertical axis) is the axis along which the greatest amount of the remaining variability lies subject to the constraint that the axes must be perpendicular (at right angles) to each other (Meilgaard *et al.*, 1991: 277).

3.8.3 Consumer evaluation

The consumer questionnaire i.e. paired preference test was analysed by applying a chi-square test, which was used to test the hypothesis of frequencies or occurrences (in other words - to determine the interaction between the taste and colour preferences) (O'Mahony, 1986:91). In a paired preference test, the probability of the selection of one specific product is one chance in two. The null hypothesis states that in the long run, when the underlying population does not have a preference for one product over another, each product will be picked an equal number of times – therefore the null hypothesis probability = 0.5 (O'Mahony, 1986:92). The paired preference test was two-tailed as, prior to the study, the researcher did not know which sample would be preferred by the respondents. Paired preference data may be analysed by either binomial, chi-square or normal distributions, respectively. All these analyses assume that the respondents were forced to make a choice and did not have the option of no-preference (Lawless & Heymann, 1998: 433-438).

Chi-square uses nominal data, which means that numbers in the scale represent nothing more than names. Certain conditions must apply when using a chi-square test such as each cell must be independent from each other. The expected frequencies should not be too small, for example, five is too small which means that frequencies in the cell cannot be normal (O'Mahony, 1986:99). For this reason, responses for the categories 'neither like nor dislike'; 'dislike a little' and 'dislike a lot' were grouped together.

Focus groups

The focus group were transcribed from the notes taken during the discussions and were summarised. The prompt list used during the discussions, guided the researcher to identify comments relative to the consumer taste test in order to establish commonalities between the consumer taste test and the focus group discussions. No particular statistical technique was applied to analyse the data.

3.9 QUALITY OF THE RESEARCH

3.9.1 Reliability

Reliability refers to the application of a particular technique that, when applied repeatedly to the same object, would provide the same results (Babbie & Mouton, 2001:119).

Nutrient analysis

As different cultivars from different regions were included in the nutrient analysis, particular care was taken in the coding of the samples to ensure that cultivars and regions were not confused. Samples were prepared according to a standardised method for sample preparation (Greenfield & Southgate, 2003: 79-82). The samples were clearly coded on the container and codes were recorded on a spreadsheet in Microsoft Excel, which accompanied all samples to the different laboratories. The proximate analyses were conducted by a South African National Accreditation Services (SANAS) accredited laboratory, and the remainder of the nutrients i.e. beta-carotene and minerals by experienced laboratory analysts in the industry i.e. Agricultural Research Institute for Soil, Climate and Water and the Medical Research Council, Tygerberg. Throughout the study, only validated methods were applied.

Quantitative Descriptive Analysis

Research design for QDA: In order to ensure that the study was reliable, a completely randomised block design was used for the descriptive sensory evaluation. Therefore, different sweet potatoes were served to the panel in a randomised order and the whole experiment was repeated for each assessor or panellist (Lea *et al.*, 1998:18). The panel had been trained according to the guidelines for training a descriptive sensory panel as described in Meilgaard *et al.* (1991:187-193).

Sensory testing environment – the sensory booths used were designed according to the American Society for Testing Materials (ASTM, 1998) guidelines. The sensory booths were in a quiet setting, air conditioned and no odours from food preparation were present.

Preparation procedures of samples used during the sensory evaluation were standardised prior to presentation to the trained panel for evaluation. The quality of the

samples served to the panel was controlled in that all the sweet potatoes were harvested on the same day, 4-5 months after planting from the same area i.e. ARC: Roodeplaat.

Consumer evaluation

Quantitative study: Sample preparation and serving procedures had been standardised and were applied throughout the study. The quality of the samples served to the participants was further controlled by ensuring that all the serving portion sizes and temperature were monitored and kept the same to all the participants.

Triangulation was applied during data collection, which is the use of multiple methods such as combining methods and investigators in the same study to overcome deficiencies from one investigator or method. In this study, selective focus groups were conducted to validate information gathered during consumer evaluation. More than one person was used to record data (such as fieldworkers / researcher) to reach consensus of the findings. The researcher also used assistants who were familiar with the type of research being conducted i.e. preference testing, in order to ensure that any gaps were identified and corrected. Triangulation is viewed as one of the best ways to enhance validity and reliability.

Extensive field notes enhance validity and reliability. During the focus groups discussions, the researcher took notes but also made use of two other observers to take notes, which were used to verify the data and findings by the researcher. Two sets of notes were kept of which one recorded information about the environment in which the study took place plus extensive observations. The other set of notes contained data regarding the researcher's theoretical memoranda and observation that could have contradicted or validated original theoretical ideas (Babbie & Mouton, 2001:275). The researcher checked the information gathered during the focus group interviews with the assistants who also took notes during the discussions.

3.9.2 Validity

Validity refers to whether a particular measure adequately reflects the concept's meaning, therefore, effectiveness of the measuring technique (Babbie & Mouton, 2001: 123).

Construct validity

Construct validity refers to the logical relationship between variables (Babbie & Mouton, 2001: 123). The literature study and conceptualisation provided a clear understanding of the concepts that were measured.

Content validity

Content validity refers to whether the measure covered that range of meanings within the concept i.e. was the complete spectrum covered. This involves the use of valid scales and valid instruments in order to achieve measurement validity. A standardised category scale was used for the sensory evaluation of the sweet potatoes (Lawless & Heyman, 1998:211; Stone & Sidel, 1993: 215) and four replications were applied during the sensory evaluation of the OFSP to ensure statistical reliability of the results.

The participants selected from the target market must be representative of the target population in order to achieve an unbiased sample (Mouton: 1998:10). A clear definition was supplied of the target population. The number of the different population groups used in this study i.e. White, Black, Indian and Coloured, were representative of the population of South Africa. In this study 182 participants participated in the study, ensuring an adequate sample size that contributed to its being representative and valid for a master's study.

Data analysis

All data was analysed by the ARC-Biometry unit, where a trained statistician guided the researcher with the statistical procedures as well as interpretation of the results. Interpretation of the results was again verified by the statistician in order to ensure that no incorrect inferences were made.

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