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THE POTENTIAL INTRODUCTION OF
***Stevia rebaudiana* (Bertoni) AS AN ALTERNATIVE**
SWEETENER IN NEW ZEALAND

A thesis presented in partial fulfilment
of the requirements for the degree of

Master in Business Studies

in
Agribusiness



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ABSTRACT

This thesis reviews the literature on a naturally occurring, non caloric sweetener, *Stevia rebaudiana* (Bertoni), a plant native to Paraguay, and analyses the potential for the introduction of Stevia and Stevia-based products as an alternative sweetener for selected groups of consumers in New Zealand. Stevia has been proved by a considerable amount of research to be a safe sweetener for people with diabetes, hyperglycaemia, digestive, obesity and skin problems.

In other countries of the world including Japan, China, Israel and Germany, Stevia's unique combination of sweetness and health benefits has caught the attention of consumers. However, Stevia remains largely unknown in New Zealand. In terms of the use and understanding of Stevia and its commercial application, Japan is the world's most advanced country. The situation of Stevia in Japan, where artificial sweeteners are banned, is significantly different from its situation in New Zealand. The Food Standards Authority for Australia and New Zealand states that while Stevia, as a plant, is a permitted sweetener, Stevia extracts are not permitted. This ruling allows the full use and promotion of artificial sweeteners that are banned in Japan while restricting the use of Stevia, which has no restrictions in Japan.

Two major health problems in New Zealand are diabetes and obesity (especially amongst Maori and Pacific Islanders), for which the introduction of Stevia and Stevia-based products in New Zealand as a substitute for other sweeteners has the potential to provide significant benefits.

Responses of four groups (general public, herb experts, diabetics and Maori – the latter ones being the target groups) to Stevia were studied through a series of consumer focus group meetings. Most participants showed interest in using Stevia as a replacement for their current sweeteners. However, participants suggested that additional information and research are required for its wider use. According to the results of this study, participants suggested that Stevia could be used as:

- A plant to be grown in home gardens: having a Stevia plant allows growers to have a natural sweetener;
- An alternative sweetener in the form of processed Stevia products, and
- An ingredient in ready-to-eat products.

The main findings of this research are:

- There is a potential market for Stevia in New Zealand;
- FSANZ regulations restricting the use of Stevia form an obstacle to its commercialisation in New Zealand;
- Participants of the focus groups prefer the powder form over other types of Stevia; and
- Food industries could use Stevia, assuming regulatory approval, as an ingredient in their products.

For the potential introduction of Stevia in New Zealand a Product Development Process (PDP) is described. A number of areas for business activities and research into *Stevia rebaudiana* (Bertoni) are suggested.

Keywords: Stevia, Stevia-based products, sweetener, natural, diabetes, obesity, Maori, artificial sweeteners, potential introduction, Product Development Process.

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CHAPTER ONE**INTRODUCTION****1- INTRODUCTION****1.1. Background**

Stevia rebaudiana (Bertoni) is a plant, native to South America, which contains the glycosides stevioside, rebaudioside and dulcoside (Glycemic Research Institute, 2000). Glycosides are natural alternatives to sugar and other artificial sweeteners that are not metabolised in the body, therefore they are eliminated with no caloric absorption (Elkins, 1997; Cardozo, 1980).

Stevioside, estimated to be 250 to 300 times sweeter than cane sugar (Mowrey, 1992), has a number of properties that make it more attractive than some of the synthetic products available. It is natural, has no calories (Mowrey, 1992) and does not affect blood sugar levels. For some 'at risk' groups, such as diabetics or those with hypoglycaemia (Richard, 1999), Stevia products allow these people to 'have their cake and eat it too'. Its non-caloric sweetening properties, together with the fact that Stevioside is heat stable to 200°C (Glycemic Research Institute, 2000), have resulted in the large-scale commercial development of this crop in a number of countries, including Brazil, Japan, Germany, Israel, China, Korea and Canada.

The use of Stevioside in extracted processed form is expanding (Bonvie et al., 1997). However, in terms of the use and understanding of Stevia and its application in food and pharmaceutical industries, Japan is by far the most advanced country (Brandle, 1998). Artificial sweeteners, such as aspartame and saccharin, are banned in the Japanese market. Consequently, Stevia holds 41% of the sweetener market there (Bonvie, L., Bonvie, B., & Gates, D., 1997a). In Japan, Stevia-based products are used as tabletop sweeteners, in soft drinks, baked goods, pickles, fruit juices, tobacco products, confectionery, jams and jellies, candies, yoghurts, pastries, chewing gum, sherbets, and other food products.

1.2. Introduction to the Research Problem

With diabetes considered a worsening world epidemic, it is important that solutions to this problem be found (International Diabetes Federation, 2003). One of the causes for the increasing rates of diabetes is said to be “obesity” (NZ Ministry of Health, 2002). One of the suggested solutions to these twin problems is the use of Stevia as a substitute for currently used sweeteners and a resulting reduction in the intake of sugar.

An epidemic of Type II diabetes is occurring in New Zealand, mainly driven “by demographic trends and the increasing prevalence of overweight and obesity, mainly affecting Maori and Pacific Islanders (NZ Ministry of Health, 2002). Elsewhere in the world, Stevia is being sold, approved and promoted as a sweetener for diabetics in Argentina, Brazil and Paraguay (J.C. Fischer, 26 December, 2002, personal communication). The incidence of diabetes in these three countries is presented in Chapter Two – Section 2.8.1. of this study. However, in New Zealand Stevia is not accepted as a legal sweetener, according to the FSANZ (Food Standards – Australia, New Zealand).

Considering the high rates of diabetes and obesity among select groups of New Zealanders, and the fact that the use of Stevia is encouraged among diabetics in South America, an alternative solution to these health issues could be the introduction of Stevia as a sweetener in New Zealand. However, a significant challenge is that Stevia is relatively unknown in New Zealand. To evaluate the reaction of New Zealanders to Stevia, the researcher investigated New Zealander’s taste preferences and opinions and their likely use of Stevia as a replacement sweetener.

1.3. Research Problem

In contrast to other parts of the world where Stevia has been used for more than 30 years, it is relatively unknown in New Zealand. It is not known if Stevia and Stevia-based products will be accepted and used as a replacement for other sweeteners in New Zealand. Their introduction as a substitute for other sweeteners (artificial and traditional) could provide significant benefits to New Zealand society. As research is conducted in

other countries, the results indicate it is safe for diabetes, hyperglycaemia, digestive problems, obesity, other weight problems and skin problems (Johnson, 1990; Mowrey, 1992). The research suggests that not only diabetics and obese people might benefit from Stevia's introduction as a sweetener in New Zealand but so might other groups.

1.4. Problem Statement

Unlike other industrialised countries, Stevia is unknown in New Zealand. In view of the potential medical benefits of Stevia, the introduction of Stevia into New Zealand could have positive medical outcomes. However, the reaction of New Zealanders to this new sweetener is unknown. In view of this, the possibility exists that New Zealand consumers, despite its alleged health benefits, might not accept Stevia.

1.5. Research Purpose, Hypothesis and Objectives

This Chapter presents the Aim, Hypothesis, and Objectives; the importance of the research, the methodology; the limitations; and the key assumptions. Finally, the layout of the thesis is described.

1.5.1. Aim

Determine if the Stevia plant and/or Stevia-based products may be accepted and used as a sweetener by selected groups of New Zealanders.

1.5.2. Hypothesis

Selected consumer groups of New Zealanders are prepared to accept and use Stevia and/or Stevia-based products.

1.5.3. Research Objectives

1. Determine if selected groups of New Zealanders exhibit a willingness to accept Stevia and/or Stevia-based products as an alternative sweetener;
2. Determine if selected groups of New Zealanders are willing to replace their current sweeteners with Stevia and/or Stevia-based products;

3. Determine consumer preferences for different types of Stevia and/or Stevia-based products amongst selected consumer groups in New Zealand;
4. Describe a possible Product Development Process for Stevia and Stevia-based products;
5. Compare the results of the study to the literature findings.

1.6. Importance of the Research

There is no reported scientific research on Stevia's production, industrialisation, consumption or use in New Zealand. This research focuses on the potential introduction of Stevia into New Zealand. The adoption of Stevia into their eating habits by New Zealanders has the potential to benefit New Zealand society. The first benefit identified is that it may be a replacement for artificial sweeteners without the side effects of the latter (Weihrauch, Diehl & Bohlen, 2001; Midmore & Rank, 2002). Second, diabetics can use Stevia as a safe sweetener. Third, since Stevia has no calories and is natural, it might help New Zealanders improve their quality of life by eating healthier through the reduction of their sugar intake. As a consequence of reducing sugar intake, Stevia may help to decrease the high obesity rates and, therefore, the diabetes rates. These benefits may result in economic benefits by reducing the health costs associated with diabetes and obesity.

In addition to the above health and social benefits possible through the use of Stevia as a replacement sweetener, other reasons for its introduction into New Zealand include: introducing it as an alternative crop for growers and specifically for organic growers; manufacturing Stevia-based products for domestic use or for export to established markets (China, Japan); or, producing Stevia containing products (e.g. dairy products) for export to the above countries. Another consideration that could enhance the introduction and promotion of Stevia products into New Zealand is the increasing number of New Zealand consumers who are diet conscious.

The objective of the focus group sessions of selected New Zealand consumers was to determine the participants' opinions about Stevia; to determine members' likes and

dislikes; and determine the advantages and disadvantages of Stevia found by the participants by comparing Stevia with their current sweeteners. The final objective was to determine if focus group members would replace their current sweeteners with Stevia. The groups selected for these meetings were:

1. General Public: to have the opinions of different people that were selected in a semi-random way.
2. Members of the Manawatu Herb Society ('plant experts'): The researcher determined it would be useful to learn the opinions of people knowledgeable concerning herbs and their production in New Zealand.
3. Diabetics (most of them were members of the Manawatu Diabetes Society): The literature review suggests this is one of the main markets for Stevia. The opinion and attitudes of this group of people was very important for this research.
4. Maori: This group is the other main market for Stevia because of the high rate of diabetes and obesity among Maori.

The researcher also proposed a Product Development Process (PDP) that could be followed in order to ensure a positive introduction of Stevia into New Zealand. The use of a PDP that is systematic and well planned allows a product to be developed completely, ensuring no details are overlooked (Perkins, 1997). If a PDP is followed for the introduction of Stevia as a sweetener in New Zealand, it is believed the probabilities of product failure will be reduced. In order to describe a PDP to introduce Stevia into New Zealand, a visit to Paraguay (the country of origin of Stevia) was undertaken.

This research has supplied information on:

- 1) Consumer preferences on Stevia characteristics, such as sweetness, aftertaste, texture, etc.;
- 2) Consumer opinions on marketing issues: price, product characteristics and product availability, etc.;
- 3) Consumer concerns about health and research issues (especially diabetes and obesity);

- 4) Consumer interest on the Stevia plant growing issues, application and form preferences of Stevia and Stevia-based products;
- 5) The advantages and disadvantages consumers identify for artificial sweeteners and sugar compared to Stevia; and
- 6) The willingness of participants to replace their current sweeteners with Stevia (totally and partially).

The researcher also summarised different forms Stevia may take in New Zealand (as a sweetener, as an ingredient for prepared products, as a plant grown in home gardens, etc.).

1.7. Preparation, Collection and Analysis Phases

The researcher's main goal in this study, is to find out:

- 1) How well known Stevia is amongst New Zealanders?
- 2) What the reactions and opinions of some selected groups of New Zealanders are about Stevia and Stevia-based products?
- 3) If these selected groups of New Zealanders are willing to replace their current sweeteners with Stevia totally or partially?
- 4) How a possible PDP for Stevia in New Zealand could be described?

Particular attention in this research was given to two target groups: diabetics and Maori. Increased attention was given to these two groups because it is these groups that could most benefit from the introduction of Stevia into New Zealand. However, two other groups (the general public and herb experts) were included to assure a broader consumer perspective on the potential acceptance of the Stevia plant and Stevia-based products.

1.7.1. Methodology

In this section the methodology used in this research is presented.

1.7.1.1. Case Selection

For this study the researcher used the Multiple Case Studies research strategy. Two target groups (diabetics and Maori) were the primary groups. A 'general public group' and a 'herb experts group' were included in order to have a broader sample selection to obtain data from the additional groups about their potential acceptance of the Stevia and the Stevia-processed products.

1.7.1.2. Data Collection and Analysis

Data collected consisted of secondary data (published data from articles, books, websites, etc.); and primary data collected from focus groups, semi-structured interviews, and questionnaires. The first part of the research focused on the collection and review of literature. The objectives of this activity were to:

- 1) Find guidance for the research;
- 2) Find out how other authors approached similar studies; and
- 3) Corroborate information from different sources.

Data for this research was obtained in a mixed form (qualitative and quantitative data). However, the main focus of the project was qualitative consumer research. This format investigates a wide range of issues and obtains detailed information about consumer attitudes, opinions and reactions.

The focus group strategy was selected because it is used for "particular purposes and specific situations – for exploring the way particular groups of individuals think and talk about a phenomenon, for generating ideas and for generating diagnostic information" (Stewart & Shamdasani, 1990:140).

For focus groups and one-on-one interviews, a semi-structured interview was used. Tape recording and transcription of the focus groups sessions were done to ensure accuracy.

To address issues that were not covered in the qualitative method, quantitative methods were selected, such as demographic information, sweetening habits, buying behaviour, etc., (to help to get specific consumers' characteristics).

The data analysis includes a “within-case” and an “across-case” analysis as suggested by Yin (1994). In the within-case analysis the collected data was converted into a case report. In the cross-case analysis the results from each case were compared and contrasted. In addition, Dey’s (1993) qualitative data analysis method was used to analyse the results. The information analyzed quantitatively described:

- The characteristics of the respondents, and
- The description of the results of the investigatory analysis.

To structure the information, section headings were used in the focus groups’ transcripts and questionnaires. The analysis of data in the focus group sessions, is described under four main areas. These are:

1. Sensory Evaluation: In this research, the sensory evaluation relates to the careful examination and judgement of the transmission of impulses from sense organs to nerve centres, especially the taste and touching senses. The subcategories that are discussed under this heading are:
 - Sweetness,
 - Flavour,
 - Aftertaste,
 - Quantity,
 - Texture, and
 - Appearance.

2. Market Issues: In this research three marketing mix categories were presented: price, place and product. The fourth (promotion) was not discussed, as it is not related to the current research. The subcategories for the Market Issues are:
 - Information,
 - Marketing,
 - New products, and
 - Competition.

3. **Health and Research Issues:** These topics are related to the soundness of body or mind; freedom from disease or abnormality; and about scholarly or scientific investigation or inquiry. The subcategories identified under this category are:
 - Safety,
 - Health, and
 - Research.

4. **Convenience:** Convenience is defined as the quality of being suitable to one's comfort, purposes, or needs. The subcategories under this issue are:
 - Growing,
 - Application, and
 - Form.

1.8. Limitations

The researcher identified some limitations:

- This was the first research on Stevia in New Zealand;
- The use of a small sample (quantity of participants and quantity of groups) limits the generalisation of the results.
- Controversial health, safety and research opinions (refer to the FDA position in section 2.7.3. of this thesis)

1.9. Key assumptions

As the researcher used information from secondary sources, there are many assumptions in this study. The most important ones are listed below:

- Stevia and Stevia-processed products are not well known in New Zealand;
- Stevia as a sweetener is considered safe;
- Stevia is most beneficial in New Zealand for people with obesity problems and diabetes (particularly Maori and Pacific Islanders);
- Obesity and diabetes rates in New Zealand may be controlled with the use of Stevia;

- The associated economic costs of the treatment of diabetes and obesity may decrease with the consumption of Stevia;
- A well-developed PDP could guarantee the success of the introduction of Stevia as a sweetener into New Zealand.

1.10. Outline of the study

This thesis is presented in five chapters. The justification and purpose for the study has been set out in this chapter together with the background and framework.

Chapter Two provides a summary of the review of literature on Stevia's situation around the world and in New Zealand. The literature on the Product Development Process is also reviewed. A proposal of a specific Product Development Process for introducing Stevia in New Zealand is given in this Chapter.

Chapter Three describes the research techniques and methods used to investigate the potential of the introduction of Stevia and Stevia-based products in New Zealand. In this Chapter the selection criteria used in the multiple case studies, the data sources, data collection and analysis are described.

The case results of each of the focus groups, a discussion of each of them, including a comparison with the literature review, are presented in Chapter Four, together with the results of the focus groups and discussion of the cross-case analysis.

The final chapter, Chapter Five, summarises the conclusions drawn from the research. Limitations of the current study and areas for future research are presented.

CHAPTER TWO**LITERATURE REVIEW****2 –LITERATURE REVIEW****2.1. Introduction**

Stevia rebaudiana (Bertoni) (referred to as Stevia) is a plant native to South America, which contains glycosides, an alternative to natural and artificial sweeteners. Apart from being a natural sweetener, claims exist for Stevia to be used for a wide range of medicinal purposes. Some of the benefits of this plant are: it is natural, it has no calories, and it has different medicinal uses and food applications. In its natural form it is 15 to 30 times sweeter than sugar; Stevioside crystals are 300 times sweeter than normal cane sugar (sucrose). In markets as diverse as China, Brazil, Germany and Israel, the use of Stevioside in extracted, processed form is expanding. In Japan Stevia is well known and widely used as a sweetener (Fujita & Eda, 1979).

Stevia is a leafy green herb, native to the Rio Monday Valley in the highlands of Paraguay which is between latitude 25° and 26°, where it grows in sandy soils near streams (Katayama et al., 1976). It had been used as a sweetener by the “guaranies” (the aboriginal people of Paraguay) long before colonisation of America. Other names for this plant are: honey leaf, sweet leaf, yerba dulce (spanish) or erva doce (portuguese), and among the Guarani Indians in Paraguay: Ka’a-he’e, Azuca-ka’a, or Ka’a-yupe. All the names draw attention to the sweet nectar like flavour of the leaf (Bertoni, 1905).

Stevia belongs to the Asteraceae family. It is related to lettuce, marigold and chicory (Kirkland, 2000). It is a small, shrubby, perennial growing up to 80 cm tall, and 60 cm wide (Shaffert and Chetobar, 1994). The flowers are small, pinkish- white and arranged in an irregular cyme (Robinson, 1930). Stevia plants can be propagated from cuttings or seeds. Since germination rates are poor and seedlings are very slow to establish, it is best grown as an annual or perennial transplanted crop (Brandle et al., 1998)

2.2. Background

Stevia's leaves have been used by the Guarani Indians from Paraguay as a sweetener for many hundreds of years. The history of its "re-discovery" and its development is described below:

16 th century: Spaniards noted the use of Stevia among natives in Paraguay. They used kaa he'e to sweeten drinks (green tea – "mate" and "tereré"), in medicine, and as a sweet snack.

1887: Moises Santiago Bertoni "discovered" Stevia after studying the herbs used by natives in Paraguay. He named the plant in 1905 in honour of Paraguayan chemist Dr. Rebaudi.

1921: U.S. Trade Commissioner George Brady presented Stevia to the Department of Agriculture, calling it a "new sugar plant with great commercial possibilities." Brady took note of its non-toxicity and its ability to be used in its natural state. He also conveyed the claims that it was "an ideal and safe sugar for diabetics."

1931: Two French chemists extracted stevioside - a white crystalline compound. They reported that it is 300 times sweeter than sugar.

1954: Japan, today the world's largest user of Stevia, began cultivating the plant domestically.

1970: Food manufacturers began marketing Stevia in Japan.

1991: The US Food and Drug Administration (FDA) banned the import of Stevia into the USA

1995: The FDA modifies its import guidelines to allow Stevia into the country as a dietary supplement, not a food additive. The difference between these two terms can be explained by the definitions given below:

Statutory Definition of "Food Additive": FD&C Act Section 201(s)

"The term 'food additive' means any substance the intended use of which results or may reasonably be expected to result, directly or indirectly, in its becoming a component or otherwise affecting the characteristics of any food..." (Ditto, 2002)

And the Dietary Supplements are:

Definition of dietary supplements in the Dietary Supplement Health and Education Act of 1994 (DSHEA), states: They are the following: vitamins; minerals; herbals and other botanicals; amino acids; dietary substances used to supplement the diet by increasing its total daily intake; and concentrates, metabolites, constituents, extracts, and combinations of these ingredients. In addition, these products must be intended for ingestion in pill, capsule, tablet, or liquid form; must not be represented as a food or sole item of a meal or diet; and must be labelled as a "supplement." (US FDA, 2001)

During the past decade, its characteristics as a naturally occurring, non-caloric sweetener has placed it as a potential competitor to artificial sweeteners and refined sugar (Fujita & Edahiro, 1979).

2.3. Plant physiology and chemistry

Stevia contains three major diterpene glycosides (Scientific Committee on Food, 1999): Steviosides (9.1%), Rebaudiosides A (3.8%) and C (0.6%) and Dulcosides (0.3%) (Glycemic Research Institute, 2000). These are natural alternatives to sugar and other artificial sweeteners that are not metabolised in the body. Therefore, they are eliminated with no caloric absorption (Elkins, 1997). The glycosides comprise 10 to 20% of the leaf dry weight, the Carbohydrates (52.8%), Protein (6.2%), Stevioside (15%), lipids (5,6%) (Glycemic Research Institute, 2000). Stevia leaves also contain fibre, phosphorous, iron, calcium, potassium, sodium, magnesium, zinc and vitamins A&C (Viana & Metivier, 1980; Elkins, 1997).

Stevioside and Rebaudioside are much sweeter products than sucrose (Richard, 1999). The Glycemic Research Institute (2000) states, that the crude leaves and the herbal green powder are typically 10% to 30% sweeter than cane sugar; but the refined extracts of Stevia (glycosides) can vary from 200 to 300 times sweeter than sugar.

According to Mowrey (1992), “the active constituents of Stevia are considered by the world’s leading food scientists as the “sweeteners of the future”. Many countries are replacing the artificial sweeteners with Stevia, mainly because Stevia is natural, safe and non-caloric and because of the negative side effects that artificial sweeteners have (Elkins, 1997). In other countries, firms that hold exclusive rights to currently used sweeteners are afraid of the future that comes with this natural, new, and revolutionary sweetener, named Stevia, over which they may have no control (Mowrey, 1992).

2.4. Uses and Properties

The established uses for Stevia products cover all those of the artificial low-calorie sweeteners (being those ones consumed in New Zealand: aspartame, saccharin,

cyclamates, acesulphame K), as well as most purposes for which sugar can be used (Midmore and Rank, 2002). Stevia and its products have a number of properties, which make them more attractive than sugar and much more attractive than some of the synthetic products available. Some of them are:

2.4.1. Stability for cooking and processing

Stevia sweeteners are heat stable to 200° C, are acid stable, non-discolouring and do not ferment. These facts make them suitable for use in a wide range of products including baked and cooked foods (Kirkland,2000; Glycemic Research Institute, 2000; Midmore and Rank, 2002). Apart from sweetening foods, Stevia extracts can increase the palatability and enjoyment of food through enhancement of flavours and odours (Ikan, et al., 1993; Mowrey, 1992). Other uses and properties Stevia has in relation to cooking and baking are:

- It has no calories and it is natural (Johnson, 1990)
- It is a non-toxic and non-addictive sweetener (Alvarez, 1986; Kirkland, 2000)
- It is potent: 250 to 300 times sweeter than sugar in its processed forms (Glycemic Research Institute, 2000)
- It helps against the carbohydrate, tobacco and alcohol cravings (Elkins, 1997)

Midmore & Rank (2002) listed some other uses in the kitchen, see Table 2.1.

Table 2.1. Food and Culinary Uses (source Midmore & Rank, 2002)

Table top sweetener – for tea, coffee etc	Candies, confectioneries
Soft drinks, cordials, fruit juices	Sea-foods, vegetables
Ice-creams, yoghurts, sherbets	Weight-watcher diets
Cakes, biscuits	Diabetic diets
Pastries, pies, baking	Flavour, colour and odour enhancers
Jams, sauces, pickles	A source of antioxidants
Jellies, desserts	Alcoholic beverage enhancer (aging agent and catalyst)
Chewing gum	

Other diet products including cordials, juices, some jams, preserves and some sweets contain chemical sweeteners in place of sugar and are potential markets for Stevia. Its suitability to be used in baking opens the potential for new, low or no-sucrose but sweet tasting cakes, biscuits, pastries etc. (Midmore & Rank, 2002).

2.4.2. Medicinal properties

Stevia products also have been reported to have beneficial uses as medicinal products. There are different medicinal applications to which Stevia has been applied. Some of them are listed below.

2.4.2.1. Hypoglycaemic action:

It is helpful for hypoglycaemia because it nourishes the pancreas and thereby helps to restore normal pancreatic function. In Brazil, Stevia tea and Stevia capsules are officially approved for sale for the treatment of diabetes (Soejarto, et.al, 1983, Oviedo, et al., 1971).

2.4.2.1.1. Diabetes treatment:

“Stevia and Stevioside are suited to both diabetics and PKU patients, as well as for obese people intending to lose weight by avoiding sugar supplements in the diet. No allergic reactions seem to exist” (Geuns, 2000). “Stevioside exerts anti-hyperglycaemic, insulinotropic and glucagonostatic actions in the type 2 diabetic GK rat, and may have the potential of becoming a new anti-diabetic drug for use in type 2 diabetes” (Jeppesen et al., 2002). For some “at risk” groups, such as diabetics, Stevia allows these people to “have their cake and eat it too” (Richard, 1999)

2.4.2.2. Cardiovascular Action:

The long-term use of Stevia would probably have a cardio-tonic action, that is, it would produce a mild strengthening of the heart and vascular system (Boeckh, E.M.A, 1986).

2.4.2.3. Anti-microbial Action:

The ability of Stevia to inhibit the growth and reproduction of bacteria and other infectious organisms is important. Users of Stevia, report a lower incidence of colds and flu, and it has been shown to lower the incidence of dental caries (Yabu, M. et al., 1977; Berry, C & Henry, C, 1981). It is also used as a plaque retardant (Elkins, 1997).

2.4.2.4. Digestive Tonic Action:

Stevia contributes to improved digestion, and it also improves overall gastrointestinal function. Stevia tea is used as a low calorie, sweet-tasting tea, as an appetite stimulant,

as a digestive aid, as an aid to weight management, and even for staying young (Kinghorn & Soejarto, 1991). Stevia is said to help in obesity or weight control problems (Elkins, 1997).

2.4.2.5. Skin Problems:

It is effective when applied to acne, seborrhoea, dermatitis, eczema, etc. Placed directly on cuts and wounds, more rapid healing without scarring takes place. One common benefit has been its soothing action on the skin (Richard, 1999; Elkins, 1992; Mowrey, 1992).

Midmore and Rank (2002) listed some other medicinal uses for Stevia:

- Toothpaste, mouthwashes – plaque retardant/caries preventor
- Skin care – eczema and acne control, rapid healing agent
- Diabetic foods and weight loss programs
- Hypertension treatment and blood pressure control
- Calcium antagonist
- Bactericidal agent
- Pill and capsule additive to improve taste

In addition to testing Stevia for these uses on animals many people use these products to maintain their lifestyle in apparent safety (Johnson, 1990).

2.4.3. Others

Stevia nowadays is not only used by people as a sweetener or a natural medicine. Some other uses listed by the CAPASTE (Paraguayan Chamber of Stevia) report (2002) are:

2.4.3.1. Agriculture: activator of crops, golf grasses, and garden grasses.

2.4.3.2. Animal production: for balanced rations, for farm animals, racing horses, pets and fishes.

2.4.3.3. Cosmetics: additives for creams, lotions, soaps and shampoos.

2.4.3.4. Environment: to decontaminate dioxin and dangerous chemicals.

2.4.3.5. Soil: as a disinfectant because it kills bacteria, filamentous fungi, seaweed and protozoaries.

2.5. Production

2.5.1. Agronomy

The natural environment for Stevia is the semi-humid subtropics of the Tropic of Capricorn (22 – 23° S latitude), 200 – 400 meters above sea level, in an area with 1,500 – 1,800 mm of rain; and in a climate with extreme annual temperatures of minus 6° C to plus 43° C (an average temperature of 21°C to 23°C) (Jordan Molero, 1984, Midmore and Rank, 2002,). It grows naturally in low lying areas on poor sandy acidic soils adjacent to swamps. (Midmore and Rank, 2002,). Stevia has been successfully taken to a wide range of climatic locations around the world. Vegetative propagation methods and seedling establishment have been used in a greenhouse before planting it in the field (Midmore & Rank, 2002).

Midmore and Rank (2002) said that there are different ways of propagation. In the wild, Stevia regenerates from seed; from the rooting of plant stems touching the ground and from regeneration at the base of the plant (crown division). Seed germination is usually very poor due to infertile seed (op.cit.). Under cultivation ,Stevia can be grown by seed, by tissue culture and by vegetative cuttings (and plant separation) (op.cit). When Stevia is planted commercially it has some important nutrient requirements. The main requirement is potassium, since it optimises the yield of dried leaves. Nitrogen helps plant growth, increasing the number of knots, the stem diameter, the number of stems but not the yield of the dried leaves. Phosphorus helps flowering (D. González, 30 January, 2003, personal communication).

When it comes to harvesting, the usual procedure is to harvest the whole green crop and transport it for either: sun or artificial drying (Midmore & Rank, 2002).

For packaging, once the leaves are dry, they can be baled the same way as tobacco and lucerne (D. González, 30 January, 2003, personal communication).

Finally, for storage, the bags have to be kept in a dry, clean place and if possible in a standing position (Alvarez, L.A., Casaccia, R. & López, G., 1994), Stevia leaves can be

stored for long period of time when they have a 10% moisture level. Storage does not affect sweetening properties. Stevia leaves should be kept in dry, clean, dark conditions, free from pests and rodents, away from the floor and walls (D. González, 30 January, 2003, personal communication).

2.5.2. Commercial Growing

According to Midmore & Rank (2002) “the plant has been successfully grown under a wide range of conditions, from its native sub-tropics to Thailand and Indonesia and the cold, northern latitudes of Leningrad, north China and Canada.” In cold climates it is grown over the summer period and it can only be harvested once a year. In tropical areas it is a perennial crop (2 to 5 years) and multiple harvests per year are possible (op.cit).

According to D. González (personal communication, 30 January, 2003) Stevia is an attractive crop for Paraguayan growers to grow. An average Stevia crop in Paraguay yields 3,000 kg per hectare, although there are growers that produce well above these levels, achieving 6,000 kg per hectare per year. The crop may be harvested 2-4 times per annum. Once established, Stevia is a relatively simple crop to grow and store. Dried leaves can be produced and stored for up to 3 years in a “low tech” system. All of these factors make this plant an attractive crop for many farmers.

Commercially there are several countries that are producing Stevia. They are: China (biggest producer: around 20,000 ha), Japan, South Korea, India, Ukraine, Australia, Canada, Mexico, The United States of America, the United Kingdom, Belgium, Germany, Spain and many countries in South America (including Paraguay and Brazil) (CAPASTE, 2002; Elkins, 1992; Bonvie et al., 1997).

2.6. Processing and Manufacturing

Stevia is used in many different forms. These forms can be classified into two main categories: leaf form (unprocessed) or extracted form (processed). The leaf form includes all forms of the plant in its natural stage (fresh or dried), and the extracted

forms can be either powders or liquids. The form of Stevia to use depends on the amount of sweetness required and the degree to which the particular recipe or beverage will benefit from the liquorice-like taste that is produced in less refined forms (Bonvie et al., 1997a). The researcher refers to both processed and unprocessed Stevia when referring to Stevia, and they are all described in Section 2.6.2.

2.6.1. Extraction methods

The use of fresh or dried leaves (pieces or ground) is acceptable in domestic cooking but does leave a sediment in clear drinks and can also leave a green colour (Midmore & Rank, 2002). Therefore processed products were introduced as another alternative.

Around the world there are hundreds of patents for Stevia extraction processes; Japan alone has around 150 of them (Angelucci, 1982; Bonvie et al., 1997a). Extraction processes were categorised by Kinghorn and Soejarto (1985), different methods of extraction are described in Table 2.2.

Table 2.2. Methods of extraction of steviol glycosides (Sources: Kinghorn & Soejarto (1985), Midmore & Rank (2002))

Method	Publication	Name
Based on solvent	Haga, T., R. Ise and T. Kobayashi (1976)	A method for purifying stevioside.
Ion exchange	Uneshi, H., R. Ise and T. Kobayashi (1977)	Purification of Stevia sweetening agent.
Absorption chromatography	Itagaki K., and Ito, T. (1979)	Purification of stevioside
Solvent and decolourising agents	T. Ogawa (1980)	Decolourisation and purification of Stevia component.
Selective precipitation of individual glycosides	Matsushita, K. and T. Kitahara (1981)	Separation of rebaudioside A by crystallisation
Ultra-filtration	Tan, S. and H. Ueki (1994)	Method of extracting and separating sweet substances of Stevia rebaudiana Bertroni.

2.6.2. Types of Stevia Products

1. Stevia Leaves:

- Fresh Leaves: have a mild liquorice flavour. This is the simplest form of Stevia, most natural and unrefined state. The leaves are used to prepare sauces but are best in herbal teas and for direct consumption. They do not dissolve! In various markets they may be purchased loose or in tea bags.
- Dried Leaves: are 10 to 15 times sweeter than sugar. To get them, one just removes all the water (the easiest way is to dry them with a dehydrator, but drying them in an oven on the lowest setting will work as well), this allows them to have an extended storage period. They have the same uses as fresh leaves but also for industrial uses to extract the stevioside.
- Tea Cut and sifted leaves: the Stevia leaves are cut into small pieces and sifted for twigs and other matters.
- Finely powdered or pulverised leaves (ground): can be found in bulk form and in tea bags. They have a greenish, leaf colour and are used as a flavour enhancer or sweetener in teas, salads, fruit, coffee, etc. Ground Stevia leaves do not dissolve.

2. Liquid Extracts:

Dark: “a concentrated syrup made from the dried leaves in a base of water and alcohol” (Kirkland, 2000).

Clear: a solution of powdered steviosides dissolved in water, alcohol or glycerin (op.cit). Especially used for the sweetening of beverages.

3. Powdered Stevia Extracts:

40-50% Sweet Glycosides: the Stevia leaves are processed through one of several extraction methods, usually water or ethyl alcohol based. The resulting powder, usually off-white, contains 40 to 50% sweet glycosides and is more than 100 times sweeter than sugar (Richard, 1999).

85-95%: the same as above, except of greater concentration, it is usually between 200-300 times sweeter than sugar.

This is the form in which Stevia is primarily used as a sweetener. Not all Stevia powders are the same. The taste, sweetness and cost of the various white Stevia powders will likely depend on their degree of refinement and the quality of the Stevia plant used (Bonvie, L. et.al, 1997)

4. Stevioside

Stevioside is the purified or most highly processed form of Stevia. It is the most powerful form of Stevia glycoside and is available in either a white powder or a liquid extract.

5. Stevia Blends or spoonable Stevia

Stevia blends combine pure stevioside extract with a filler to make an easy-to-measure great tasting powder. Because of the great strength of stevioside, manufacturers combine Stevioside with a filler. These blends are the most versatile and easy to use form of Stevia.

The Stevia to sugar ratio most commonly used is 4:1. The types of fillers used in Stevia Blends according to Kirkland (2000) are:

- Lactose: It is derived from milk. It has a slightly sweet taste and dissolves instantly.
- Maltodextrin: It is a non-sweet complex carbohydrate that is virtually tasteless. It can be derived from corn, rice, tapioca or other starches and has a very low glycemic index.
- F.O.S.: This is the common term for Fructo-oligosaccharides. It is a sugar found in a variety of common foods like bananas, garlic and wheat.
- Dextrose: It is a common processing agent derived from corn sugar.

6. Stevia Packets

These normally contain the same ingredients as Stevia blends, except in convenient and pre-measured servings.

7. Stevia Quick dissolving tablets

They normally contain stevioside along with other ingredients and are mainly used to sweeten beverages.

Bonvie et al. (1997) state that “one of the challenges in using these various forms of Stevia in cooking and beverages lies in finding just the right amount to suit your taste and recipe”.

The same authors also wrote that “not all stevia extract powders are the same. The taste, the sweetness and cost of the various white stevia powders will likely depend on their degree of refinement and the quality of the Stevia plant used”. Some of the powders have more of an aftertaste (Bonvie et al., 1997). In this sense, it is important to clarify what it is understood by the quality of Stevia. May (2001) wrote:

“Good quality stevia leaves, whether whole, cut and sifted or in tea bags, are about 30 times sweeter than sugar and have no calories. The best quality leaves are imported from South America and Mexico, and are about 12 percent to 13 percent stevioside. The poorest quality, but most ample supply, is currently coming from China, where the leaves contain only about 5 percent to 6 percent stevioside. A simple taste test quickly demonstrates the difference.”

Furthermore, Kirkland (2000) says that the quality of any Stevia product depends on the amount of steviosides it contains, the percentage of rebaudiosides, the cultivation and the extraction methods. The same author also suggests that the additives present at any time during growing, harvesting or processing are an important issue for the final quality of the product.

2.7. World situation

According to Midmore & Rank (2002) the main Stevia producing countries are China, Paraguay and adjacent parts of Brazil (Table 2.3.); furthermore China is the main supplier to Japan, which is the main commercial producer and user of steviosides.

Paraguay and Brazil are the main countries that produce and distribute Stevia products direct to consumers via health food and herbal product outlets and by direct mail order sales around the world (op.cit). In these two countries there are a number of processors who have company plantations of 2 to 300 hectares (Elton-Johnson, 1990, Oddone, 1999)

Table 2.3. Some Countries Where Stevia is Grown and Researched (Adapted from Midmore & Rank, 2002)

Country/ Location	Commercial Production (1)	Research	Non- Agricultural research	Approved for use
Paraguay	++	++	++	++
Brazil	++	++	++	++
Mexico	+	+	+	+
USA		+	++	
Canada		+	+	
China	++	++	++	+++
Japan	+	++	++	+++
South Korea	+	++	++	++
Thailand	+	+	+	+
Vietnam	+	++	++	+
Taiwan	+	++	+	++
Russia	+	++	++	+
Ukraine/Moldova	+	+	+	
Spain		+	+	
Italy		+	+	
United Kingdom		+	+	
Germany		+	+	+

(1) Commercial production excludes small quantities grown for domestic use.

Stevia and its products are used in Japan, China, Korea, Taiwan, Malaysia, Israel, Brazil, Paraguay, Argentina, Mexico, Ukraine, Philippines, Germany (Bonvie et al., 1997a) In the United States, Canada, Australia and New Zealand it is sold as a Dietary Supplement (Elkins, 1992).

2.7.1. Situation in Japan

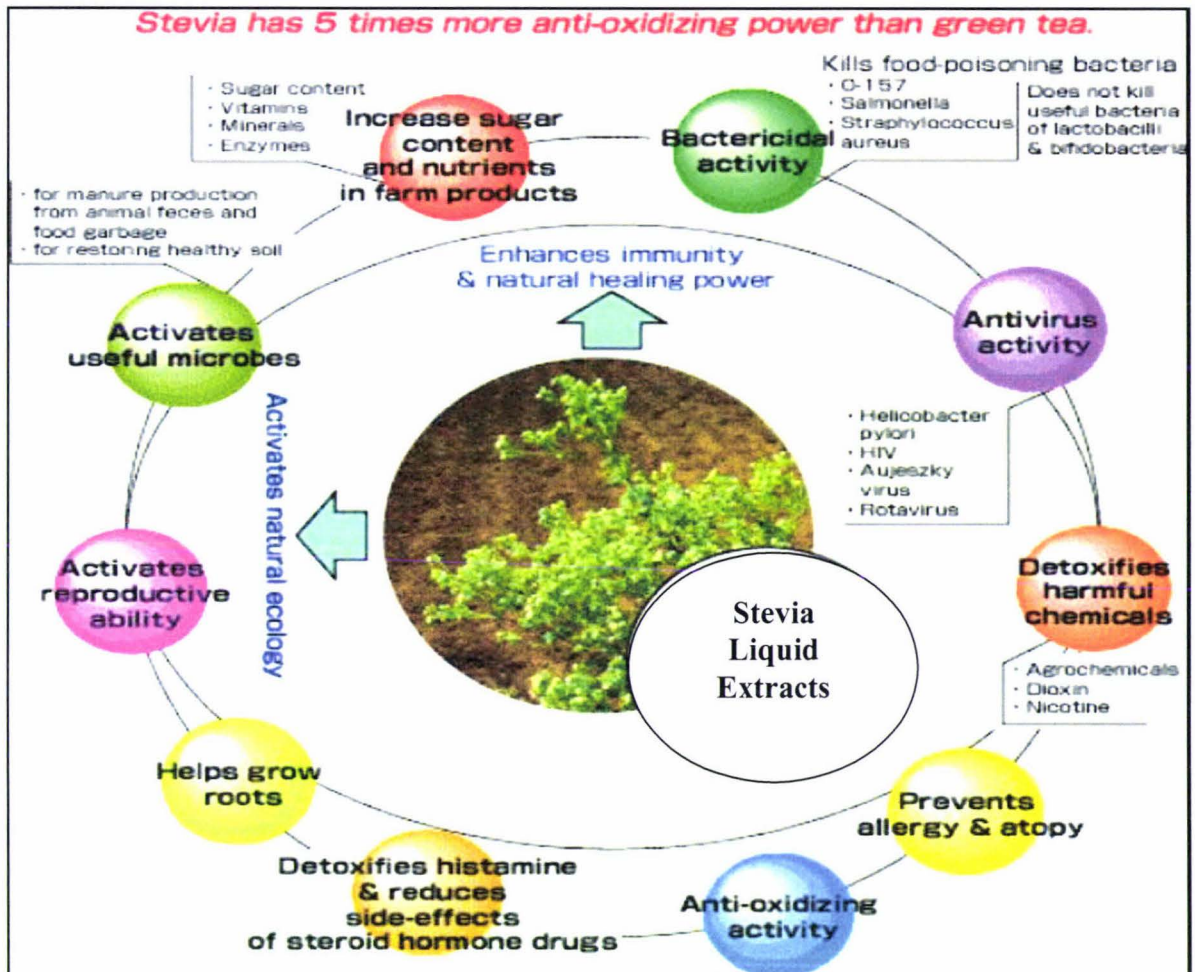
Around 1,500 scientific research works on Stevia have originated in Japan. In terms of the use and understanding of Stevia and its application, Japan is by far the most advanced country in food and pharmaceutical industries (Brandle, 1998).

Japan is the current world's leading Stevia consumer as approximately 2000 t of Stevia extracts are consumed there annually (Richard, 1999; Midmore & Rank, 2002). 95% of the raw material used in Japan comes from four major producers in China (Midmore & Rank, 2002).

It is difficult to understand how a "...a natural, low-calorie, safe for diabetics, non-pharmaceutical sweetener that is widely used in other countries, including Japan (whose Ministry of Health is notoriously more strict than the FDA), cannot be openly sold as a sweetener in this country (USA)" (Bonvie et al., 1997, p.7).

In Japan, Stevia is used in their sugar-free version of Wrigley's gums, yogurts, diet coke, ice cream, bread, candies, pickles, seafood, vegetables, fish meat products, ciders and teas (Johnson, 1990; Richard, 1999). Besides its uses as a sweetener in Japan, they also use Stevia for other different things. The Japanese try to utilise the whole plant, not only the leaf. Figure 2.1. shows the different applications the Japanese have for liquid extracts of Stevia, that not only affect the people's health and wellbeing, but also animals, ecology, soil, etc. (JBB Stevia Laboratory, 1988).

Figure 2.1. Applications and Research Achievements of Stevia Extract Liquid (Adapted from: JBB Stevia Laboratory – Japan)



For purposes of comparison it is useful to examine the current status of Stevia in New Zealand and Japan (See Table 2.4.). While the use of Stevia as a sweetener is restricted in many countries that do accept the use of artificial sweeteners, such as aspartame, saccharin, and so on, these sweeteners are banned in Japan and Stevia is permitted (Fujita & Edahiro, 1979, Strauss, 1995).

Table 2.4. Current Status of Stevia

Japan	New Zealand
<ul style="list-style-type: none"> ➤ Stevia holds 41 % of the sweeteners market! (Bonvie et al., 1997a) ➤ Artificial sweeteners such as Saccharin and Aspartame were banned or strictly regulated (H.Fujita, T. Edahiro, 1979) ➤ Japanese food processors use Stevia and its products in a wide variety of applications (Richard,1999) ➤ There are several Stevia manufacturers who have formed the Stevia Association of Japan (Richard,1999) 	<ul style="list-style-type: none"> ➤ Stevia is almost unknown and accepted only as a dietary supplement ➤ Artificial sweeteners such as Aspartame and Saccharin are consumed and used in food preparation with no restrictions ➤ Stevia products can only be found in health shops as a dietary supplement ➤ There are no Stevia manufacturers, neither an Association of Stevia

2.7.2. Situation in Paraguay

In Paraguay, according to the CAPASTE (Paraguayan Chamber of Stevia) (2002), there are approximately 650 ha of cultivated Stevia. To ensure Paraguay is the country which produces most of the best quality Stevia, the CAPASTE stated as its principal objective to achieve the cultivating of 30,000 ha of Stevia within 10 years. The advantage of Paraguay over other countries is that the crop can be harvested 3 to 4 times in a year. And, the Stevia clones used there have amongst the highest rates of stevioside and rebaudiosides in the world.

Most of the Paraguayan production of Stevia leaves is sold to the United States of America (USA), either as cut dried leaves or fine green powder (J.C. Fischer, 26 December, 2002, personal communication). In the USA they then process it into the forms the final consumers want, following the local regulations for Stevia preparation.

2.7.3. Regulation in the United States

According to the Federal Food, Drug and Cosmetic Act of 1994 (revised April 2000), Section 402 (a) (2) (c), Section 409 and 21 CFR 170 and 21 CFR 189-1, Stevia is a substance "Prohibited from use in human food." Per 21 CFR 190, Stevia may be sold in

the United States as a stand-alone "dietary supplement" or herb, but not as a sweetener. The US FDA authorities base their position on results of the study published in 1968 that claimed that certain tribes of Indians in Paraguay (the Matto Grosso) used Stevia tea as a contraceptive (Planas & Kuc, 1968). This position was unchanged even after other studies showed that stevioside does not affect either growth or reproduction in animals (Yodyingyuad, & Bunyawong, (1991), Takanaka, Kawashima, Usami & Sakami, (1991), Bonvie et al., (1997)).

The Stevia market in the US is currently in strong competition with artificial sweeteners, but these are losing ground in the health war stakes, as the market becomes more health conscious (Midmore & Rank, 2002).

2.7.4. Regulation in the European Union

The European Unions (EU) position on Stevia, is given in the Document 300DO196, 2000/196/EC, which says: "The Commission Decision of February 22, 2000 refused the placing on the market of Stevia rebaudiana Bertoni: plants and dried leaves as a novel food or novel food ingredient under Regulation (EC) No. 258/97 of the European Parliament and the Council (notified under document number C) (2000) (77) Official Journal L 061, 08/03/2000 p. 0014". It appears that the commission will change this position once they believe there are sufficient safety tests and research done to allow Stevia's inclusion into the food market.

In apparent contradiction to this EU position, there are some countries which grow and use Stevia including: Germany, Belgium, Italy and the United Kingdom (Glycemic Research Institute, 2001, Bonvie et al., 1997a, Kirkland, 2000). People in some of these countries are also conducting research on Stevia (op.cit.)

2.7.5. The Food Standards Australia New Zealand (FSANZ) Position on Stevia

An Australian Rural Industries and Development Corporation report, in conjunction with Central Queensland University, detailed the FSANZ position on Stevia. The aim of

the Report was to address FSANZ for registration of Stevia for use in the food industry in Australia and to determine the economic feasibility of growing and processing Stevia within Australia (Midmore & Rank, 2002).

The FSANZ position is (Source: FSANZ Information sheet as a respond to application A397. Prepared 9 August 2001):

Stevia

Stevia (whole leaf, crushed leaf) is considered to be a food and therefore can be legally sold in Australia and New Zealand.

Stevioside and extracts of Stevia

Stevioside (or a concentrated extract of stevia) is considered to be a plant extract¹, which serves as an intense sweetener. There is no permission in either Volume 1 (The Australian Food Standards Code) or Volume 2 (the joint Australia New Zealand Food Standards Code) to use or sell Stevioside in Australia or New Zealand.

2.7.6. Safety of Stevia sweeteners

Stevia sweeteners have a long history of use in South America and now in Japan and there are no reports of adverse effects (Brandle et al., 1998). There has been considerable media attention in the USA, including claims and counterclaims before the US FDA (Midmore & Rank, 2002). Many of these claims relate to its potential competitive position in relation to aspartame (op.cit.). The general safety of steviosides could be largely due to the fact that they are not broken down nor absorbed in the digestive tract (Hutapea, 1997). Studies on food safety, including an extensive review of literature, undertaken prior to 1982 (Kinghorn, 1982 and Lee, 1979) concluded that Stevia leaves and extracts are safe.

There is a Stevia website (Stevia.net) where many Safety studies are shown. One of the quotes cited in the website says:

"...various extract forms of stevia have been extensively studied and tested. These tests include acute, sub-acute, carcinogenic evaluation and mutagenicity studies. These

¹ A plant extract is considered to be a food additive if it fulfils a technological function normally associated with a food additive, eg, an intense sweetening function.

scientific data, while not directly relevant or required for exemption under the common use in food proviso, nevertheless demonstrate cumulatively that there is no safety problem associated with the use of an extract of stevia. It appears to be extraordinarily safe." (Introduction to GRAS (generally recognised as safe) affirmation petition submitted by the American Herbal Products Association, April 23, 1992).

To give another example, in Japan where artificial chemical sweeteners are not approved, and in other countries, there have been many toxicology safety studies conducted on Stevia (Johnson, 1990). The results confirmed Stevia's safety.

Lately, the interest in sweetening agents has increased dramatically. This interest may be explained by the global concern over the rates of diabetes and obesity amongst the population. These concerns were recently highlighted by a joint report from the World Health Organisation and the Food and Agricultural Organisation that suggested a significant reduction in sugar consumption as a way to improve health and reduce sugar-caused diseases (Independent expert report on Diet and Chronic Disease, 2003).

2.7.6.1. Artificial sweeteners

A German article pointed out: "Artificial sweeteners have rapidly evolved over the last 20 years and have been added to a broad variety of food, drinks, drugs, and hygiene products. Since their introduction, the media, especially mass media have reported potential cancer risks, which have undermined the people's sense of security. It can be assumed that every citizen of western countries are using artificial sweeteners-knowingly or not. A cancer-inducing activity of one of these substances would mean a health risk to an entire population" (Weihrauch et al., 2001).

The fact that people know about the side-effects artificial sweeteners have, is not stopping the consumption of the chemical sweeteners, which are not only used as table top sweeteners but are also ingredients of almost all diet products offered in the market. The fact that many side effects and illnesses are said to be caused by artificial sweeteners, makes consumers think about natural alternatives to artificial sweeteners (Elkins, 1997, Bonvie et al., 1997).

Therefore, the increased interest in Stevia may be a consequence of the falling popularity of artificial sweetening agents, the increased consumers' interest in natural organic products and that researches have found its potential benefits for diabetics, high blood pressure, obesity, etc.

2.7.6.2. Stevia's safety controversies

In many countries, including New Zealand, governmental regulations limit the availability of Stevia and Stevia containing products. In other countries, however, these are readily available. These differences in governmental acceptance of Stevia indicate there are controversies around this South American plant's acceptance as a sugar substitute. This situation is unusual for the food industry, where demand is one of the key aspects that rules and decides about the businesses success or failure.

2.7.7. Consumers opinions on Stevia in other countries

Since there is no available information on the opinions of New Zealanders about Stevia (because it is still relatively unknown), the opinions of Stevia consumers from other countries (especially the USA) are presented below. The researcher, selected those which have to do with the main areas of interest for this research: sweetness, flavour, aftertaste, etc.

2.7.7.1. Sweetness

A botanist of the U.S. Department of Agriculture, first noticed Stevia in 1918. He recalled that he "*learned about Stevia while drinking mate² and tasted it years later, finding it to have a remarkable sweetness*" (Bonvie et al., 1997a).

"The sweetness of (stevia) satisfies my craving for sweets; also it helps keep the blood sugar balance." (Mowrey, 1992)

An article written by Sabrina Marie (from the Grain and Salt Society) contains some opinions of people who tasted some food containing Stevia-based products that were presented in the Grain and Salt Society. The testers shared these comments:

² Traditional tea prepared with yerba mate (*Ilex paraguariensis*).

- Cheryl, who does not have any specific health problems but is strongly affected by sugar said, *“I am very excited about stevia. I loved the stevia sweetened cookies we tested. I think stevia gives me a good feeling, compared to the highs and lows of white sugar. I think it is going to play a role in my diet, especially for breakfast foods which are often overly sweet.”*

This person highlights the sweetness of Stevia and expresses her concern about the high and lows the consumption of sugar gives.

- Jon, who is in good health though worried about weight gain said, *“The stevia cookies were good, but they had a “cool aid” kind of aftertaste. I just think brown sugar is hard to beat, I wouldn’t choose to eat stevia if there was a plate of brown sugar sweetened cookies being offered at the same time.”*

This person, on the other hand, mentioned that there was an aftertaste and that it would be hard to change to Stevia if brown sugar baked cookies were offered.

- Christiana, who is currently on a completely sugar-free diet because of candidiasis, said, *“I love stevia. I use the liquid extract in my tea. I think it’s wonderful that even though I have candidiasis and cannot eat any type of sugar or fruit, I can have a little taste of something sweet without affecting my health.”*

The opinion of this person is limited by the fact she has candidiasis, for which Stevia is said to be good and acceptable.

- Nichole, who is a recent wholesome foods convert, said *“I think stevia is great. After testing all the sweets made with stevia, I wanted more. When it’s used just right, it can be a great alternative to sugar. I also like the fact that you need to use so little stevia, compared to the cups and pounds you must use of white sugar.”*

Beside the fact of liking Stevia's sweetness, this person mentioned the quantity issue, which was important to her.

2.7.7.2. Flavour and aftertaste

"If Stevia is used in a less refined form (such as crushed leaves), spices such as cinnamon and ginger can help mask any aftertaste" (Bonvie et al., 1997a).

While there is no question that stevia is sweet, many users will admit that they have also experienced a bitter aftertaste from some brands. In fact, one of the problems with the stevia products currently available from health food retailers, is that many of them just do not taste good. They often have a distinct grassy taste, with varying degrees of bitterness associated with the sweetness. These differences in quality may partly be a result of using non-Paraguayan stevia, partly due to poor extraction and processing techniques, to the quantity used, and partly the result of ignorance on the part of manufacturers concerning the real nature of the stevia plant (Movrey, 1992).

"The bitter principles are actually found in the veins of the leaf, while the leafy material between the veins contains the sweet components. Great care must be taken during production of stevia extract to avoid contaminating the sweet with the bitter. This pertains as much to extraction as it does to milling." (op.cit.).

In all of its current forms, stevia has a taste unique to itself, people say. With all of its sweetness, some report that there is a bitter taste when the leaf, extract or stevioside powder is placed in the mouth. This bitter taste disappears, as does the slight liquorice flavour, when the product is appropriately diluted in water or another liquid prior to use (May, 2001).

2.7.7.3. Texture and appearance

"We are intrigued by the honey-leaf sweetener . . . and started to use it in our bread making to test it for our diabetic customers. We were so pleased with the results and the

improvement in the texture and softness, that we have continued to use it on a regular basis in our bread and so have all of our customers, diabetic or not." (Mowrey, 1992).

People's opinions about subjective areas such as: sweetness, flavour and aftertaste, differ very much from one another. There are those who like it, those who are neutral and those who dislike these characteristics of the products prepared with Stevia. The opinions presented here, had a more positive response in this sense. However, there are several comments that prove that many people feel a bitter taste or an aftertaste after tasting the leaves, and some of the products. The quantity used is an important factor to make that unpleasant taste disappear.

There is not much said about the texture and appearance of the products cooked and baked with Stevia. Some believe that the texture changes a little, but others disagree with that. When the leaf is used to sweeten food or beverages, the colour changes, but if processed Stevia products are used, the appearance is not an issue.

2.8. Stevia in New Zealand

Although Stevia is well known and used in many countries around the world, it is still unknown in New Zealand. Few people know about its existence and there have been almost no articles written about it in the newspapers, magazines or journals. From six articles in the newspapers, one was written in 1997 in "The Daily News". The remaining five articles were all written in the year 2002 in the following newspapers: "The Press", "The Daily News", "The Southland Times", "The New Zealand Herald", where all of these mentioned Stevia amongst other products as a novelty without being a major topic. The latest article in a newspaper was in "The Evening Standard" which related to the research the author of this project is writing.

Apart from these articles in the Newspapers, there were two articles in different magazines. One article in 1998 was published in the "The Tree Cropper". This article written by Roger and Shirley Meyer included general information about Stevia: its

origin, names, benefits, properties and uses. And the latest article, published in “Organic New Zealand”, covered general issues about Stevia and how to grow it.

Excluding the article in “The Evening Standard” and the one in “Organic New Zealand”, none of the other articles referred specifically to Stevia in New Zealand.

The introduction of Stevia as a sweetener could be beneficial for New Zealanders, because it could be used as a sugar replacement for diabetics and certain cultural groups that are more vulnerable to obesity and diabetes (Maori, Pacific Islanders). In the next section this situation is presented with more details.

2.8.1. Situation

According to a “Facts and Figures” report of the International Diabetes Federation (2003), there are currently more than 194 million people with diabetes worldwide; if there is nothing done to slow the epidemic, the number will exceed 333 million by 2025. The report continues that at least 50% of all people with diabetes are unaware of their condition, in some countries this figure may rise to 80%. “Diabetes is the fourth main cause of death in most developed countries. For each risk factor present, the risk of cardiovascular death is about three times greater in people with diabetes as compared to people without the condition.” (op. cit.). The forecast is that by 2025, the prevalence of diabetes is expected to triple in Africa, the Eastern Mediterranean and Middle East, and South-East Asia, to double in the Americas and the Western Pacific and to almost double in Europe (op.cit.). In South America, specifically in Argentina, Paraguay and Brazil, Stevia is being sold, approved and promoted as a sweetener for diabetics (J.C. Fischer, 26 December, 2002, personal communication; FUPADI, 31 January, 2002, personal communication). According to the World Health Organisation database (2003), the diabetes figures for these countries will increase as is presented in Table 2.5.

Table 2.5. Total people with diabetes in Argentina, Brazil and Paraguay (Source: WHO Database for Regional Office for Americas, 2003)

Country	2000	2030
Argentina	1426152	2457044
Brazil	4553003	11305516
Paraguay	102237	324326

Table 2.5. shows that there is an increase of diabetes cases expected for these countries. The prevalence estimates of Type II diabetes for these three countries are 2% to 4.99% (International Diabetes Federation – Diabetes Atlas, 2003). In this respect, the International Diabetes Federation report (2003) continues in its report stating that,

“For developing countries, there will be a projected increase of a 170% of cases; for developed countries, there will be a projected rise of 42%. It is estimated that diabetes accounts for between 5% and 10% of a nation's health budget. The human and economic costs of diabetes could be significantly reduced by investing in prevention, particularly early detection, in order to avoid the onset of diabetic complications.

There is conclusive evidence that good control of blood glucose levels can substantially reduce the risk of developing complications and slow their progression in all types of diabetes. The management of high blood pressure and raised blood lipids (fats) is equally important. Diabetes increased by one-third during the 1990s, due to the prevalence of obesity and an aging population.”

In New Zealand, diabetes and obesity are of increasing concern especially amongst certain cultural groups (NZ Food: NZ People, 1999). According to a press release from the NZ Ministry of Health, Chief Maori Advisor Dr Tony Ruakere, the majority of Maori adults are either overweight or obese. “Key Results of the 1997 National Nutrition Survey found that nearly six out of every ten Maori adults were either overweight or obese” (Press Release NZ Ministry of Health, 1999).

These results should be a concern for the authorities since the fact that being overweight puts a person at far greater risk of serious health problems such as heart disease and diabetes (Press Release NZ Ministry of Health, 1999).

The report's findings also show that specific health and nutrition programs are needed for Maori people if these problems are to be overcome. In this respect as was previously mentioned, Stevia is being used as a treatment for diabetes type II and to help with weight problems.

More recent research shows even worse scenarios in these respects. The NZ Ministry of Health states that “The incidence rates for Maori and Pacific peoples are more than three times higher than the European rates, and Maori and Pacific peoples are more than five times as likely to die from (diagnosed) diabetes” (NZ Ministry of Health, 2002).

The researcher therefore believes that the control of diabetes and obesity are of critical importance to New Zealand specifically for Maori and Pacific Island communities. The NZ Ministry of Health publication also states that between 1996 and 2011, deaths resulting from diabetes may surpass 2100, with Maori deaths by increasing nearly 70%, and European diabetes related deaths increasing by 20% from 1996 levels (see Tables 2.6 and 2.7.). The same report also states that “the number of new diagnoses of diabetes in 2011 is forecast to exceed 11,000, and the number of people known to be living with diabetes may exceed 145,000.” (op.cit).

The NZ Ministry of Health states that in the projected increase of the prevalence of diabetes, obesity is a major driver, accounting for nearly a third of the overall increase in diabetes (op.cit).

Table 2.6. Modelled 1996 (diagnosed) diabetes counts (Source: NZ Ministry of Health 2002)

Number	Male			Female			Total
	Maori	Pacific	European	Maori	Pacific	European	
New diagnoses	585	165	1 709	720	197	1 366	4,742
Existing diagnoses	7 014	2 003	31,790	9 291	2 686	28,707	81,491
Attributable deaths	238	56	498	274	61	367	1 494

Table 2.7. Forecast 2011 counts (Source: NZ Ministry of Health 2002)

Number (forecast)	Male			Female			Total
	Maori	Pacific	European	Maori	Pacific	European	
New diagnoses	1,532	469	3,653	1,934	575	2,907	11,070
Existing diagnoses	16,202	4,991	51,408	21,649	6,558	44,105	144,913
Attributable deaths	403	103	618	454	105	421	2,104

The recommendations for slowing down this epidemic, are to improve nutrition and raise physical activity levels among all population subgroups, the NZ Ministry of Health reported.

2.8.2. Benefits to New Zealand

There is no systematic research conducted on Stevia's consumption, use and production in New Zealand. There are some aspects in New Zealand that should be considered important when thinking about conducting research for the introduction of Stevia into its market. Since New Zealand shares the same common food standards as Australia, it will tend to follow Australia's lead for regulatory acceptance of Stevia, which in some ways is positive, because Australia has more advanced research on Stevia. However, it also may have some negative effects, as Australia has a significant sugar industry (it is the world's 4th largest sugar exporter) (USDA – FAS, 2001) that might delay or oppose comprehensive research into Stevia. Therefore, it would be good if New Zealand started its own research on Stevia, and it may even be the country that gets regulatory acceptance of Stevia in the FSANZ.

Other ways New Zealand could benefit from the introduction of Stevia are:

1. It would improve the populations nutrition by decreasing the sugar intake, which is considered to be one of the factors that leads to obesity, which is one major problem causing diabetes;
2. It could be a potential treatment for Type II Diabetes;
3. Obese people, overweight people, weight watchers and common people could use it to loose weight and improve their diet and nutrition;
4. People with high blood pressure could use it as a helpful means to help lower their blood pressure;

5. It is useful for other health problems for which Stevia is said to be good (dental, skin, etc.)

Beside these health and nutrition benefits, Stevia could also be useful for other reasons in New Zealand:

1. A cropping alternative for growers and organic growers
2. Potential use of sandy and coastal areas
3. Manufacturing of Stevia-based products for domestic use or for exportation to already known markets (China, Japan).
4. Produce Stevia containing products (e.g. dairy products) and export them to the above cited countries and other large users of Stevia, and even open new markets.

A major benefit to New Zealand of the increased use of Stevia as a sweetener could result in a decrease in Type II diabetes. In addition, the use of Stevia could also lead to a reduction in the occurrence of obesity and other diseases commonly associated with high levels of sugar consumption. These benefits will not only benefit the people, but also the government since health campaigns against diabetes and obesity are being held. The reductions in obesity would directly reduce associated health costs.

If these issues are considered to be important and the interest in Stevia is positive, the introduction of Stevia and Stevia-based products into New Zealand should be done, if possible, following a Product development Process. This enables the carefully planning of each of the stages and follows a pattern that will permit successful implementation. In this respect, the researcher summarised what was found about the Product Development Process and has presented it below.

2.9. Product Development Process

Considering that one of the objectives of this thesis is to “describe a possible Product Development Process for Stevia and Stevia-based products”, and that one of the research questions is “What product development process would work best to analyse

the potential commercialisation of Stevia and Stevia-based products in New Zealand?"; it is considered that one of the theoretical frameworks that will guide the research is the Product Development Process.

Buisson and Reid (1996) define the new product development process as the involvement of activities and decisions from the time an idea is generated until the product is sold; a model is useful for controlling the various activities involved in the development of a new product, and provides a skeleton around which each project manager can build a critical path for development.

Perkins (1997), states "The Product Development Process (PDP) is essentially the conception, development, testing and commercialising of products". To understand this definition better it is worth defining "Product". In *The American Heritage* (2000) a product is defined as "Something produced by human or mechanical effort or by a natural process". In this sense it can be seen that Stevia is included in what people call product.

West (1980), relates the PDP to particular firms, but further adds that the PDP can also involve changes to the "technology and/or the market". In the case of this project a Wests' second situation applies, as Stevia, a widely recognised product elsewhere is new to the New Zealand market.

The use of a development process that is systematic and well planned, allows a product to be developed completely, ensuring all details are not overlooked (Perkins, 1997). According to Kerr (1994, p.1) "the aim of the product development process is to coordinate development activities, optimise the product's market potential and reduce the inherent risk of developing new products".

Stevia plants and Stevia-based products are known and used in many countries, as substitutes for traditional sweeteners (sugar, honey, artificial sweeteners, etc.).

Before proceeding with a description of PDP, it is worth considering the case of Paraguay's Stevia industry which has developed in a haphazard rather than planned fashion³ way.

2.9.1. Paraguayan Product Development Process

During a Home Located Research in Paraguay, the researcher wanted to find out what Product Development Process was utilised and designed in the country of origin of Stevia, to use it as an example for the New Zealand situation. However, there was no such process neither designed nor described. All interviewees supplied some information about Stevia's situation in Paraguay, with which a Stevia development process was designed and is shown below:

1. Paraguayan aborigines used Stevia as a sweetener for centuries. Colonisers found out about that when getting together with the Guarani Indians (Jordan Molero, 1984)
2. Stevia was classified scientifically (Bertoni, 1905)
3. In the 1970's it was suggested that Stevia should be a commercial crop, considering Paraguay's advantages. But nothing significant was done about it (Jordan Molero, 1984).
4. In the 1990's the crop emerged again but then enthusiasm disappeared (ABC, 1992) until the year 2000.
5. Around the year 2000, particular businessmen showed an interest in Stevia and began a movement to develop the crop. A PDP was put in place (by the CAPASTE), and although there was popular use of it, the development of Stevia as a commercial product failed. The PDP followed is described below:

5.1. Opportunity Identification: there was a herb with innumerable properties which grew wild in Paraguay and was produced commercially in other countries with seeds and seedlings taken from Paraguay. There was also a demand for Stevia, but there was no supply.

³ Information for this section was collected by the researcher in semiformal interviews to Stevia industry members in Paraguay.

- 5.2. Concept Screening: see in what forms Stevia was being commercialised and try to do the same.
- 5.3. Business Analysis: they analysed the production and commercialisation and concluded it was worth giving it a try.
- 5.4. Product Development: production is the main activity (so until now all of it is sold as dried leaves), but industrialisation is in process.
- 5.5. Commercialisation: select markets that are willing to pay for quality. Commercialise the product in the form buyers want it.
- 5.6. Other process activities (regulatory approval, registration, patent process, etc.): they created the Paraguayan Chamber of Stevia (CAPASTE) to follow up, give technical support to producers, sell the products to different markets, support research, etc.

A process model is necessary for planning, organising and controlling the activities and stages involved in the development of a new product or an existing product for a new market. Ideally the development of every product will include all the stages or at least most of them, but in reality the type and quantity of research in each stage varies between product and project (Schaffner et al., 1998). If no development process is followed, the pre-2000 Paraguay situation could be repeated.

2.9.2. Product Development Approaches

Since the use of Stevia and its products is not a new concept for the market (hence for most New Zealanders they are) as new products would be, the product development process for them will differ from those called traditional processes. The traditional processes vary a little from each other depending on the author, situation and product, but at the end follow the same objective: introduce a product successfully into a market with the acceptance of the consumers.

To identify what product development process will fit best for the Stevia project in New Zealand, and then describe it, it is useful to analyse and compare different approaches used for the PDP.

The first table (Table 2.7.) compares four approaches that classify their processes into steps. The processes are similar but authors use different names and some identify the various steps. In Table 2.8. the basic steps that can be identified in all four approaches are: a) idea or project identification; b) concept development and evaluation; c) product development; and d) testing and launch.

Table 2.8. Different Product Development Process Approaches

Traditional Product Development Process (Bartol et al.,2001)	New Product Research (Aaker et al., 1995)	New Product Development Process (Page, 1993)	The Product Development Process (adapted from Rudolph, cited in Schaffner et al., 1998)
1.Opportunity Identification	1. Generating new product concepts: - concept generation - need identification - concept identification	1. Concept Search 2. Concept Screening	1. Project Set-up 2. Product idea generation and screening
2. Concept Development	2. Evaluating and developing concepts	3. Concept Testing 4. Business Analysis	↑ ↓
3. Product Design 4. Process Design	3. Evaluating and developing actual product	5. Product Development 6. Product use testing, field testing, and/or market testing	3. Product Design 4. Product Testing 5. Production and Marketing development
5. Commercial Production	4. Testing the marketing program	7.Commercialization 8. Other process activities (regulatory approval, registration, patent process, etc.)	6. Product launch 7. Post launch review

The second table (Table 2.9.) on the other hand, first classifies the activities under three main areas: pre-development (activities which occur up until the actual technical trial development of the product or process), development (actual technical and marketing development) and commercialisation (market launch). Both tables however differ in some of their steps, but coincide in some other activities.

Table 2.9. New Product Development Process, classified according to three phases (Source: Buisson & Reid, 1996, p. 13)

	Booze Allen Hamilton, 1982	Cooper & Kleinschmidt, 1986	Crawford, 1991
Pre- Development Phase	<ul style="list-style-type: none"> ➤ Exploration ➤ Screening ➤ Concept testing ➤ Business Analysis 	<ul style="list-style-type: none"> ➤ Initial screening ➤ Preliminary market assessment ➤ Preliminary technical assessment ➤ Detailed market study ➤ Pre-development business & financial analysis 	<ul style="list-style-type: none"> ➤ Strategic planning and opportunity identification ➤ Ideation ➤ Screening
Development Phase	<ul style="list-style-type: none"> ➤ Development ➤ Testing 	<ul style="list-style-type: none"> ➤ Product development ➤ Inhouse product tests ➤ Customer product tests ➤ Trial production ➤ Trial selling ➤ Pre-commercialisation business analysis 	<ul style="list-style-type: none"> ➤ Development (technical development and market appraisal)
Commercial Phase	<ul style="list-style-type: none"> ➤ Commercialisation 	<ul style="list-style-type: none"> ➤ Production start-up ➤ Market launch 	<ul style="list-style-type: none"> ➤ Commercialisation ➤ Launch

The situation for this research is however not quite the same as for a completely new product. After all, Stevia products are in use already in some parts of the world. If knowledge about Stevia can be taken from one situation and transferred to another it is reasonable that a revised PDP, especially described for Stevia's introduction to New Zealand, can be developed. The stages in such a shortened PDP are described next.

Table 2.10. Design of a generalised PDP (mix between all approaches presented before)

Phases	Steps
1- Pre-Development Phase	Project set-up Product concept generation -Idea, concept and need identification Concept screening Concept testing Product design
2- Development Phase	2.1. Product development 2.2. Product testing 2.3. Field testing 2.4. Marketing development
3-Commercial Phase	3.1. .Production start-up 3.2. Product launch 3.3. Commercialisation 3.4. Post-launch review

Dividing the PDP in three phases (Table 2.10) allows the managers to plan, organise, implement and control the steps better. The first phase, the pre-development phase, is very important in this process, because the success of the product development will

depend on it. If the first phase is planned carefully and steps 1.1., 1.2., 1.3., 1.4., and 1.5. are followed, the second phase will depend more or less on the market acceptance of the already existing product. And finally, if the third phase is reached, it means that all tests had positive results, so it all depends on the implementation and control to maintain the product in the market.

2.9.3. Product Development Process for New Zealand

The process required to generate a new idea is not the same for a newly created product as it is for introducing an existing product into a new market. Hence, the step regarding the new product development process is irrelevant in this situation. Similarly, as the concept of using Stevia and related products has already been undertaken elsewhere, this step in the PDP is again redundant. A reduced PDP, which takes account of these changes, is described below.

The PDP for the Introduction of Stevia, an existing product, into the New Zealand, which is a new market, comprises of three phases. Each phase and its contents are described below and summarised in Table 2.11.

Table 2.11. Design of the PDP of Stevia and/or Stevia-based products into New Zealand (Adapted from other approaches presented above):

1 - Pre-Development Phase	1.1. Opportunity identification/need identification 1.2. Product idea generation and screening Business Analysis
2 - Development Phase	2.1. Product Development and/or use testing, field-testing and/or market testing Marketing Development
3 - Commercial Phase	3.1. Commercialisation Post launch review 3.3. Other process activities

Stevia Development Process description of the table 2.9.

1 - Pre-development Phase:

1.1. Opportunity Identification – Need Identification: there is great potential for the introduction of Stevia into New Zealand. Factors such as the high rate of diabetes and obesity problems amongst New Zealanders – especially Maori (NZ Ministry of

Health, 2002), are good reasons. The aims, objectives and constraints of the project have to be stated at this stage (Bartol et al., 2001 & Aaker et al., 1995).

1.2. *Product Idea generation and screening*: critical analysis of product and target market (Schaffner et al., 1998). The product already exists, the analysis would focus more on the target market and in what forms or presentation this market wants the products (plant, powder, dried leaves, syrup, etc.).

1.3. *Business Analysis*: evaluation of the product concept in financial terms as a business proposition (Page, 1993). The questions to be asked here could be:

- Is it worth producing it commercially in New Zealand? (Cost-wise: see if it is not too expensive to introduce Stevia as a crop; production-wise: natural resources (varieties, species, seeds, water, soil, etc.) and climatic conditions (weather, rain, seasons); quality (will the varieties have high contents of Stevioside and Rebaudioside); market (internal or external or both); etc.), or
- Is it better to buy in dried leaves and process them in New Zealand?, or
- Is it better to import crystals and extracts and process them into finished products?, or
- Is it best to just import the finished products and have plants for those who want to grow them by themselves?

2- Development Phase:

2.1. *Product Development and/or use testing, field-testing and/or market testing*: evaluation of market success, quantitative and qualitative analysis of market (Page, 1993 & Schaffner et al., 1998). Offering the product to a pre-selected group of potential buyers to determine its suitability and or marketability.

2.2. *Marketing Development*: prediction of outcomes. Marketing strategy (Schaffner et al., 1998). After gathering the information from the consumers, the analysis of data should give the information about:

- What consumers prefer?
- How they prefer the product?
- Why they prefer it that way?
- Where they want to buy that product?

- When they will buy it?
- How much they are willing to pay for the product?
- How much of the product they will buy?
- How often they will buy it?

3- Commercial Phase:

3.1. Commercialisation: launching the product, analysis of sales, buying behaviour; consumer or customer acceptance (Page, 1993 & Schaffner et al., 1998).

3.2. Post launch review: product and/or market improvement efficiency analysis (Schaffner et al., 1998).

3.3. Other process activities: regulatory approval/registration and patent process filing (Page, 1993).

This research will mainly focus on the first phase (pre-development phase) and on the first suggested step for the PDP in New Zealand – the need identification; because it studies the opinions and reactions of certain groups of people towards food and beverages prepared with Stevia.

The New Zealand market presents some limitations for the development of new products. The main reason for these is New Zealand's business environment (West, 1980). Some of the most important ones are:

- Isolation from other industrial centres of the world (Hill, 1994)
- New Zealand's population of only 3.98 million people (Statistics New Zealand, 2002);
- Relatively low per capita discretionary income (Hill, 1994)

For the Stevia development process, Market Orientation⁴ is an important focus, because the market (customers) are the main target. The success of the introduction depends on the acceptance of the market and most importantly on the use and buying behaviour. In

⁴ Market orientation is the organization-wide generation of market intelligence, or information on customers' current and future customer needs, dissemination of that information across departments, and organization-wide responsiveness to it (Deshpande, 1999)

this sense, Narver & Slater (1990, cited in Kahn, 2001) stated, “research has shown a positive relationship between market orientation and product development performance”.

Two different views are considered relevant at this point. First, the one designed by Narver & Slater (1990, cited in Kahn, 2001), which characterised market orientation as having three behavioural components:

1. Customer orientation: in this research, this will be the most important target because the product developed is designed to satisfy their needs and values.
2. Competitor orientation:, and
3. Inter-functional coordination

Second and more suitable for the Stevia research is the one designed by Ruekert (1992, cited in Kahn, 2001) and Atuahene-Gima (1995, cited in Kahn, 2001) which portrayed market orientation from a customer perspective where:

1. Gather customer information
2. Develop Strategic plan
3. Implement plan
4. Respond to customer needs

Therefore the strategic plan should carefully be designed and implemented in order not to waste time, money, and other resources. As Day (1997, cited in Cravens et al., 2000) wrote “customers drive strategy and executives must adapt their organisations, structures, roles, and activities to the changing requirements of customers”. The launch of Stevia in New Zealand, should be directed mainly to the diabetics and the Maori, because these two groups are the ones that can benefit most from a product such as Stevia. The main reasons for this are:

- It has been proved that diabetics can consume Stevia with Diabetes type II;
- There are research results that suggest Stevia can be used for the treatment of diabetes type II;
- It is a natural sweetener, with 0 calories that is not absorbed by the body;
- Maori people like to grow their own plants, Stevia is a healthy option;

- Maori people like sweet things, Stevia could be their sugar substitute with no side effects.

But, these points are not just for the specific groups listed, all New Zealanders could benefit from Stevia and/or Stevia-processed products as well.

2.10. Conclusion

Stevia rebaudiana (Bertoni) is a naturally occurring non-caloric sweetener that could be the perfect substitute for both artificial sweeteners and refined sugar. The worldwide demand for high-potency sweeteners and organic products is expected to increase, especially with the new practice of blending different sweeteners (Brandle et al., 1998). Stevia involves just these characteristics with the added advantage that Stevia sweeteners are natural plant products (op.cit.).

Research into the beneficial aspects of Stevia, especially Type II diabetes, high blood pressure and obesity, indicate that Stevia could have a positive impact on the health of New Zealanders as well as on their wellbeing and the possibility of including a new crop. In this sense, one of the potentials for New Zealand could be to convert Stevia from a wild plant to a modern crop well suited to efficient mechanised production. Another option is to industrialise it, by using home-grown raw material or imported from other countries such as Paraguay and export finished products such as dairy products, soft drinks, candies, pastry, etc. containing Stevia to markets such as Japan, China and others.

The market opportunity appears to be great, some countries consume big amounts of artificial sweeteners (stevioside-like sweetness products), and it is well known that some of these artificial sweeteners are not safe any more (Bonvie et al., 1997a; Richard, 1999; Kirkland, 2000), therefore health conscious people, diabetics, obese people and others may start thinking about consuming something safer and healthier as Stevia, in the near future.

The fact that Stevia is natural and that it has been used for centuries in other countries and in addition to this the fact that scientific research has also shown Stevia's safety, is a positive sign that Stevia is a beneficial substance that can be used without any bad consequences. The barrier that it is not approved yet in many countries is not one raised by scientific concerns, but rather by commercial concerns and bureaucratic intransigence (Bonvie et al., 1997a).

The high rate of diabetes, the number of health-conscious people and the national passion towards gardening in New Zealand are some reasons why the author believes it could be a good reason to start thinking about growing and using Stevia in New Zealand. Therefore the selected groups for this research were: general public, herb experts, diabetics and Maori, to formulate a general opinion but also a more specific opinion of the target market (diabetics and Maori) about the potential of introducing Stevia into New Zealand.

CHAPTER THREE**METHODOLOGY****3- RESEARCH METHODOLOGY AND TECHNIQUES****3.1. Introduction**

This section describes the method and techniques used for this project, and includes the explanation of why these were proposed and used. It outlines the *Procedure* used, which explains what was done and how; the *Sample* selected, which explains who participated in the study, how many participants there were and how they were selected; and the *Instruments* used in the study (Emerson, 2000). In addition, the methodology details the data collection methods (Emerson, 2000).

The selection of the methodology depends on the objectives, the research questions, the context of the problem and the abilities and attitude of the researcher (Patton, 1990). For this research, a description of the process of selecting the case studies, implementing the data collection and the Qualitative Data Analysis are given. Following this, the process for comparing and contrasting the data within case and between cases is described.

To find out if Stevia and/or Stevia-based products are likely to be accepted and consumed by New Zealanders the researcher used a range of different techniques such as: focus groups, personal interviews and survey to gather information. This research aims to describe the potential for introducing and steps to be taken to introduce Stevia to the New Zealand market. Procedures to undertake such a process have been as being a Product Development Process (discussed previously in Chapter 2 “Literature Review”).

3.2. Selection of Research Strategy

To select the research strategy, the following questions should be considered:

- What will the research be about?
- What problem will be solved and what question/s will be answered?
- How will that problem be solved?, and
- Why was it decided to solve it that way?

To answer these questions, the researcher had to analyse the different methods and techniques available to do research. Yin (1994) wrote that each research strategy has peculiar advantages and disadvantages, depending upon three main conditions:

- a. the type of research question asked;
- b. the extent of control an investigator has over actual behavioural events; and
- c. the degree to which contemporary information is used as opposed to learning about historical events.

Yin (1994) designed a Table (see Table 3.1.), which displays the three conditions and shows how each of them is related to five research strategies in the social sciences.

Table 3.1. Conditions to select an appropriate Research Strategy (Source: Yin, 1994)

Strategy	Form of research question	Requires control over behavioural events?	Focuses on contemporary events
Experiment	How, why	Yes	Yes
Survey	Who, what, where, how many, how much	No	Yes
Archival analysis	Who, what, where, how many, how much	No	Yes/no
History	How, why	No	No
Case study	How, why	No	Yes

Considering this table, the focus of this thesis is *How* is Stevia to be introduced into New Zealand? *How* can the researcher find out if New Zealanders are going to accept and use Stevia? *How* would New Zealanders prefer the product to be made available to them? *Why* do they want it this way? *Why* is it considered important that Stevia should be used by New Zealanders?; *Why* is a Product Development Process recommended to introduce Stevia into New Zealand?.

Control over behavioural events is not possible, since the researcher has no control over the behaviours of participants. Contemporary events are the subject of this research, so a Case Study strategy was selected. When comparing case study strategies with survey research, the main differences are that surveys usually answer the question “what” when

what one really needs to know is actually a form of “how many” or “how much”. In this case “a survey can be readily designed to enumerate the ”whats” whereas a case study would not be an advantageous strategy in this situation (Yin, 1994, p. 6). Both, Case Study and survey could be used, but the focus of this research is the understanding of “how” and “why”, so a Case Study is more suitable. For Bouma (2000) the case study answers the question “What is going on?” and focuses on a single case or entity, which could be a person, a group, a town, etc.

The main characteristic that identifies a Case Study from other research strategies is that it is an empirical inquiry that investigates a current situation within its real-life context especially when the boundaries between the situation and the contextual conditions are not very evident (Yin, 1994). Hamel, Dufour & Fortin (1993), described the Case Study as follows: “...it proves to be the descriptive study, par excellence and in depth. The Case Study thus serves as the most complete and detailed sort of presentation of the subject under investigation”.

3.3. Case Study Design

According to Yin (1994, p.18) “the research design is the logic that links the data to be collected (and the conclusions to be drawn) to the initial questions of a study”. To design a research project Yin (1994) proposes that five components should be considered: a study’s question, its propositions, its unit(s) of analysis (what the “case(s)” is/ are, the logic linking the data to the propositions and the criteria for interpreting the findings (data analysis steps). When choosing the research design, the researcher should consider some logical tests to be sure the design selected is the best available method for the problem under consideration. Kidder & Judd (1986, p. 26-29) summarised these tests as follows:

- *Construct validity*: establish correct operational measures for the concepts that are studied
- *Internal validity* (for explanatory or causal studies, not for descriptive or exploratory studies): establish a causal relationship, with which certain conditions are shown to lead to other conditions

- *External validity*: establish the domain to which a study's findings can be generalised.
- *Reliability*: demonstrate that the operations of a study (e.g. the data collection procedures) can be repeated, with the same results.

These four tests may be considered relevant in judging the quality of a research design (Yin, 1994). Therefore, when collecting the data and analysing it, the researcher must to consider these points and try to accomplish them in order to achieve a good quality project.

To construct validity the author used some of the recommended methods (Gray, 2001):

- Multiple sources of evidence: focus groups, interviews, documents, surveys;
- Multiple instances of the construct and the establishment of the chain of evidence: the data in itself and the data analysis method;
- Use of constructs from the literature.

The internal validity in this research refers to the question of whether the researcher sees what is thought to be seen (Gray, 2001; Goodwin & Goodwin, 1996). Internal validity of qualitative research has some threats that should be avoided: changes in the observer, observer bias or misinterpretation, reactive effects (Gray, 2001). To avoid some of these biases the researcher chose to use the following tactics: notes, peer reviewing, monitoring of possible bias, multiple sources of corroborative evidence, pattern matching (to identify relationships) and comparing the evidence to confirm or refute rival hypotheses (Gray, 2001).

The external validity refers to the question generalisability, and it is achieved by establishing the domain or locations in space and time to which the results can be generalised (Yin, 1989). The general threats to external validity were minimised by providing a detailed description of the cases and the context and by using a purposeful sampling (Gray, 2001). The findings of this research cannot be generalised to the entire population of New Zealand because only a small number of cases were analysed. The last criterion by which a research is tested is reliability. Reliability is achieved when the

same research can be done by another researcher and produce the same results, therefore it can be said that the aim is to minimise the errors and bias in research (Yin, 1989). The researcher writes all the procedures and findings in order to provide them to others who are interested in verifying or conducting the research.

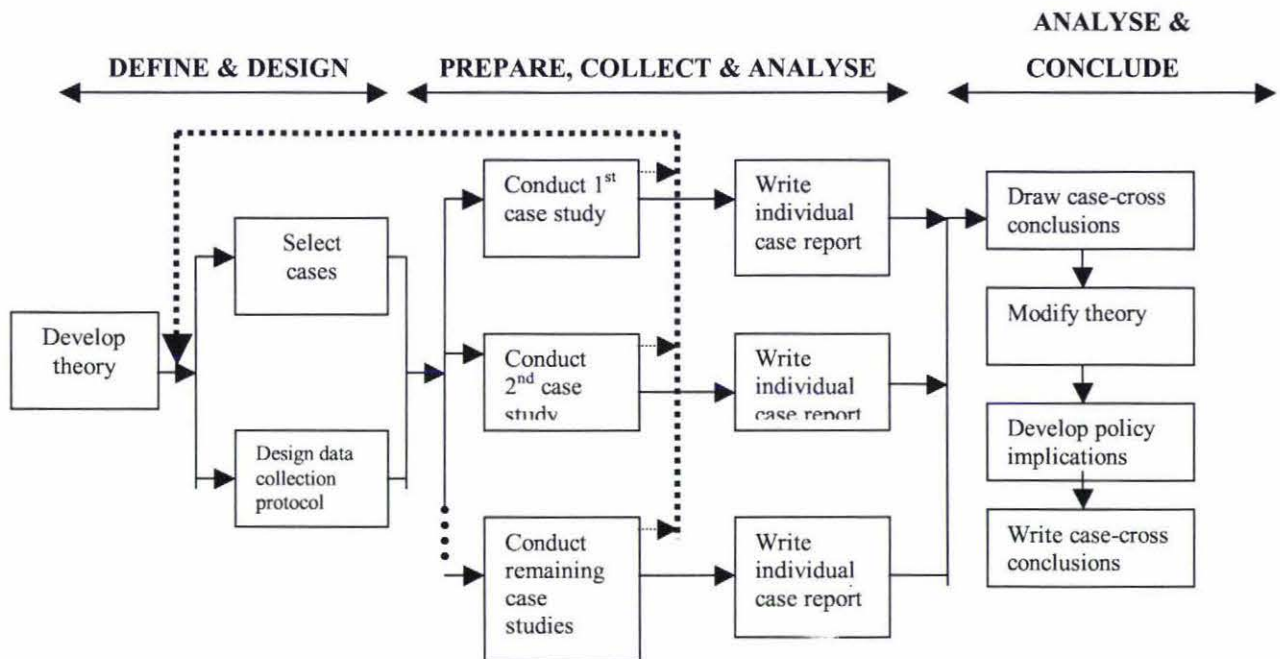
3.3.1. *Multiple Case-Studies*

Before the researcher decides on how to collect the data, he/she should be sure about opting for a *single-case study* or *multiple-case studies* (Yin, 1994). According to Yin (1994) both designs remain within the same methodological framework. A rationale for a single case is when it represents the critical case in testing a well –formulated theory; a second rationale is when it represents an extreme or unique case and a third rationale is the revelatory case (Yin, 1994). A single case study can also be used as a pilot case for a multiple-case study. When research contains more than a single case it is named a multiple-case study; the evidence from multiple-cases is considered more compelling, more robust (Herriot & Firestone, 1983 cited in Yin, 1994).

In this respect, this research used multiple-case studies since it does not test a well-formulated theory, it does not represents an extreme or unique case nor is it a revelatory case as simple case studies are. One of the research questions is whether or not Stevia will be likely to be accepted by selected groups of New Zealanders, therefore four different groups were selected to comprise the focus groups (more detail is presented on this later on the Focus Groups section, number 3.5.3.1.).

According to Yin's classification, this research uses a multiple-case study design that follows the flow chart designed by Yin (1994). To facilitate understanding of this classification an illustration which shows the stages relevant to Multiple Case Studies Methods projects is presented (see Figure 3.1.)

Figure 3.1. Multiple Case Study Method (source: Yin, 1994)



3.3.1.1. Definition and Design Phase

Once the research problem was defined and the questions formulated, the “*Definition and Design*” phase started with an initial review of the literature and other available sources, to identify important concepts, connections and relationships to enable theory to be developed. Stevia’s current situation, research, Product Development Processes, different qualitative methods were the main areas searched. The theory developed was then used for the selection of the case studies (this part will be discussed later with more details) and for the design of the data collection protocol (to be shown in the data collection section) and to analyse the results.

3.3.1.2. Preparation, Collection and Analysis phase

During the second phase “*Preparation, collection and analysis*”, data were collected from each of the case studies – this being a Qualitative Data collection method. Focus Groups were the main source for data collection, but other methods were used including: interviews, questionnaires and literature. Yin (1994) suggests that when deciding about the sample size, one should think of this decision as a reflection of the number of case replications – both literal and theoretical. Data were collected in a semi sequential form

through Focus Groups, a small number of surveys, interviews and documents during a period of one year. Some preliminary data analysis was undertaken at the end of the year, but the in-depth analysis was undertaken to complete this thesis.

Each Case Study was analysed using the Qualitative Data Analysis (QDA) technique suggested by Dey. Then the results were summarised as single-case reports first, and then case-cross analysis was performed to enable comparisons to be made. This was done this way because the researcher wanted to first find out what each of the different groups thought about Stevia and their attitude towards it. Preliminary results helped the researcher to notice that additional areas in the literature needed to be covered and this aspect required further investigation; therefore the need for doing:

1. some more questionnaires;
2. some interviews in Stevia's home country "Paraguay"
3. investigation into actual medical research about Stevia and its current situation.

3.3.1.3. Analyse and conclude

The final phase of the research process described by Yin (1994) is the "*Analysis and Conclusion*". This phase included the final analysis of data and the drawing of the cross-case conclusions, the modification of theory and writing up the cross-case report and conclusions. If necessary the conceptual model is modified or adjusted according to the findings.

3.4. Case Selection

The case selection has no specific boundaries, so the researcher should feel free to select the cases that best fit into the problem and objectives. It focuses mainly on the type of research that is being used as well as other key factors such as:

- Research objectives and questions;
- Research purpose;
- Research time and available resources; and
- Availability of sample.

Vaughan (1992), pointed out three main areas that should be covered when defining cases:

- Specification of similarities and differences;
- Explanation of the impact of these on the case study findings; and
- Specification of the theoretical consequences for comparison between cases.

These points help to construct a “blueprint” of the research that would help other researchers to understand and follow the necessary steps to get the same or similar results. If - on the contrary - these are not shown, it would be difficult to see the reliability concept (Vaughan, 1992).

According to Gray (2001), case selection involves two key questions: 1) what criteria are used to select it?, and 2) how many cases will be studied? Again, the decisions about sample size and the sample strategies depend on decisions about the appropriate unit of analysis as was discussed earlier.

Patton (1990) stressed the fact that “the evaluation design specifies the unit or units of analysis to be studied”, the decisions about sampling strategies (sample size and sampling), depend on prior decisions about the appropriate unit of analysis to study. The same author highlights the fact that the focus of data collection will be on what is happening to individuals in a setting and how they are affected by the setting. “In any research design the choice of a sample facilitates both control and generalisation” (Philliber, Schwab & Sloss., 1980, p.62). A sample, then, is any selection of units to be studied; these units come from a population or universe of interest (Philliber et al., 1980). The units of analysis investigated in this study are a group of the general public, a group of the Herb Society, a group of diabetics and a group of Maori (the reasons why these were selected are presented in the Literature Review and their description are presented later on).

The groups selected for this thesis were:

1. General Public: to have the opinions of different kinds of people that were selected in a random way. Age, gender, profession, ethnicity did not matter. The

only condition was that they had to be New Zealanders or that they had to be people who shopped in the New Zealand marketplace and had done so for sometime.

2. Members of the Manawatu Herb Society – “plant experts”: The researcher thought it would be useful to know the opinions of expert people in the area of herbs, since they know most of the herbs, their benefits, properties, growing conditions, commercialisation channels, prices, and so on. And they know New Zealanders’ attitudes towards new herbs, preferred form, commercialisation and so on.
3. Diabetics (most of them members of the Manawatu Diabetes Society): The literature review suggests this is one of the two main markets for Stevia in New Zealand. The opinion and attitudes of this group of people is very important for this research. According to the information gathered by the researcher there is a high rate of diabetes in New Zealand and Stevia could be a good alternative sweetener for them.
4. Maori: This group is the other main market for Stevia due to the high rate of diabetics and obese people among Maori. The researcher wants to find out if Maori would accept, use and/or grow Stevia.

All the groups were people living within the Manawatu area to allow ease of access to the researcher, because of the limited resources and time available. Participants had to be aware of the Focus Group approach, what was expected from them and what they would get from it. The selection was made semi-randomly, since the researcher had some people who helped recruiting the participants who filled in the specific characteristics sought.

During a trip to Paraguay the researcher conducted 6 interviews with different members of the Paraguayan Chamber of Stevia (CAPASTE) to find out about Paraguay’s current situation with Stevia and other information relevant to this research.

3.5. Data Collection

Cooper and Schindler (1998), suggest that the data-gathering of the research process should start with pilot testing. A pilot test is conducted to detect weaknesses in design and instrumentation, it should simulate the procedures and protocols that have been designated for the data gathering (Cooper & Schindler, 1998).

In this research, it can be considered that the first focus group was the pilot test since the selected group was a general public group. The researcher thought it would be useful to have their opinions as well and at the same time use it as a pre-testing. That decision was useful since the researcher was able to learn a lot from and identify many defects, gaps and errors in conducting the focus group. An assistant also helped in this matter, writing down the suggestions and corrections for the moderator (the researcher), which helped the researcher to improve the performance in the next focus groups that were conducted.

Evidence for case studies may come from many different sources (Yin, 1994), including: documentation, archival records, interviews, direct observations, participant observations and physical artefacts. The researcher decided to use some of these that will be mentioned later on.

In addition to the individual sources Yin (1994) mentions three other principles that are important for the data collection, and for the final quality of the report. These are:

1. Multiple sources of evidence: not only one, but a combination of sources;
2. Case study database: a formal assembly of evidence different from the final report;
3. Chain of evidence: links between the questions asked, the data collected and the conclusions.

3.5.1. Collection Strategies

Within case study strategies information may be derived in either a *quantitative* or *qualitative* form. Kelly (2002) summarised the characteristics and main differences of the qualitative and quantitative research methods in (Table 3.2.).

As can be observed (Table 3.2.) this study has more characteristics of the qualitative research strategy. The aim of the research is to study some particular cases and understand them. The researcher and observed are inseparable, the nature of knowledge is value –laden and fallible. The main part of the research uses words as the nature of data, but here is where the researcher also uses some quantitative methods, because she collected and analysed surveys. The generalisability is context dependent since the sample size is small.

Table 3.2. Idealised viewpoints of the quantitative and qualitative research strategies (Adapted: Kelly, 2002)

	Quantitative	Qualitative
Aim of research	Study general Explanation leading to prediction	Particular study Understanding
Role of the researcher	Unbiased Objective	Biased Influences the research
Logic of methods	Primarily deductive	Primarily inductive Theory building, data to theory, participants observation, interviews (Gray, 2002)
Nature of data	Numbers	Words
Data collection	Standardised instruments and measurement	Researcher as instrument Emergent procedures
Sampling	Random/statistical	purposive/ theoretical small number of cases (Gray, 2002)
Data analysis	Statistical	Categorisation and pattern matching
Causal linkages	Real causes with effects	Cause and effect inseparable
Generalisability	Generalisable to a population, across space and time	Generalisations are context dependent

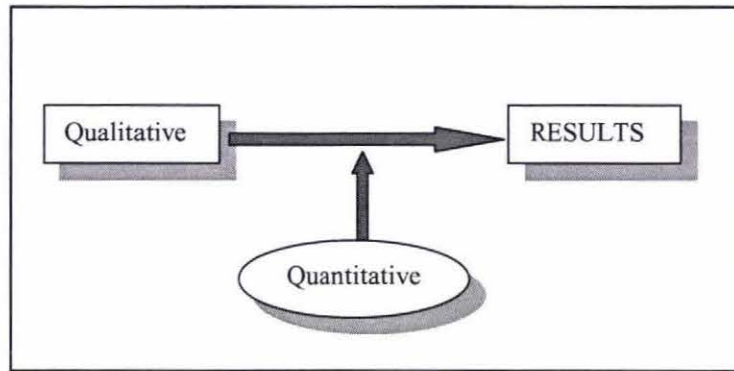
According to Cooper and Schindler (1998, p.134) “the qualitative refers to the meaning, the definition or analogy or model or metaphor characterising something”, while the “quantitative assumes the meaning and refers to a measure of it”.

Patton (1990) made an interesting comparison about the sampling in the qualitative and quantitative methods; he suggested that *qualitative* inquiry typically focuses in depth on relatively small samples, that are selected purpose-fully; on the other hand *quantitative* methods typically depend on larger samples selected randomly. The same author also pointed out that when considering the sampling size, the researcher has to be more aware of what he/she wants to find out, why she/he wants to find it out, how the findings will be used and what resources he/she has for the study.

The methodology used for this research is based on obtaining data in a mixed form, since both qualitative and quantitative approaches were used. Bryman (2001) compared four different types of mixed methods; he illustrated four different scenarios for combining qualitative and quantitative methods. One of these scenarios is the one chosen for this study (see Figure 3.2.). The qualitative method is the dominant design while the quantitative is the supporting method – DOMINANT less dominant design = QUAL/quan, as described by Bryman (2001). This project focused mainly on qualitative consumer research, which according to Chambers and Smith (1991) can be used to investigate a wide range of issues and obtain detailed information about consumer attitudes, opinions, perceptions, behaviours, habits, and practices. The qualitative methodology is based on obtaining first-hand knowledge of phenomena (Gray, 2002). According to Greenbaum (1988) one of the most frequently used qualitative methods is the *focus group*.

Therefore the data collection methods used for this study are: qualitative method (Focus Groups and interviews) and some quantitative methods (questionnaires). For the qualitative approach the sampling was more purposive/selected, and the number of cases is small (Table 3.2.).

Figure 3.2. Combination of qualitative and quantitative methods (Source: Bryman, 2001)



The following standards data collection approaches were used:

3.5.2. Documentation or Literature Review:

The researcher used the literature review as it is helpful for different reasons:

- It focuses the research;
- It guides the research in a specific direction;
- It helps to find out how other authors approached similar studies;
- It allows the author to review previous research in the areas of concern and delineate and structure the study according to the findings;

According to Yin (1994):

- It provides other details to corroborate information from other sources,
- Inferences can be made from documents and other sources.

For this thesis the literature reviewed was mainly on:

- Stevia's current situation worldwide, and more in detail in Japan and Paraguay;
- Stevia's properties, uses, benefits;
- Types of Stevia and Stevia-based products;
- Product development processes, description and application;
- Qualitative Data Analysis (QDA).

3.5.3. *Qualitative Interviews*

Patton (1990) defined the purpose of interviewing as the allowance to enter into the other person's perspective. He continues by stating that the qualitative interviewing begins with the assumption that the perspective of others is meaningful, knowable, important, and able to be made explicit. Yin (1994), highlights the fact that the interview is one of the most important sources of case study information. According to Patton (1990, p.280) there are three basic approaches to collecting qualitative data through open-ended questions:

1. the informal conversational interview (spontaneous generation of questions in the natural flow of an interaction);
2. the general interview guide approach (outlines a set of issues that are to be explored with each respondent before interviewing begins); and
3. the standardised open-ended interview (set of questions carefully worded and arranged).

Tolich and Davidson (1999, p. 108) divided the interview into three parts:

- Introductory questions to start the informant talking,
- A list of recurrent themes that represent the project's research interests,
- A set of generic prompts (such as "how?", "tell me more", etc.)

The two different interviews used in this study were: focus groups and one-on-one interviews. The researcher tried to use the guidelines cited previously. For the focus groups a semi-structured interview was used because that allowed the interviewer to ask her structured, precisely worded questions but at the same time have some flexibility in including or covering certain areas that had not previously been considered. For the personalised interviews there were differences between one and another. Four out of the six interviews were semi-structured as discussed before. The remaining two were more like the informal conversational type because the researcher just wanted to have information on those areas as references not to include them in the research.

Patton (1990) specifically mentions the “Recording of Data”. He stresses the fact that a tape recorder is part of the indispensable equipment of researchers using qualitative methods; it increases the accuracy of data collection, and most importantly it records the raw data of interviews that are the actual words spoken by interviewees. A tape recorder permits the interviewer to be more attentive to what the interviewee says, however, notes were also taken. These allow the interviewer to formulate new questions, and they facilitate later analysis (Patton, 1990).

The researcher used tape recorders in all the interviews, with no exclusion. Patton (1990) recommends that despite the costs of transcribing interviews, full transcriptions are the most desirable data to obtain because they are enormously useful for the data analysis and for later replications or independent analysis of the data. The researcher had the discussions, which took place in all the focus groups transcribed.

3.5.3.1. Focus Groups

Focus groups produce data of interest to researchers, and in this respect their purpose differs from those of other kinds of group interactions in which the goals vary from reaching consensus to making decisions among alternatives (Krueger, 1994)

3.5.3.1.1. Definition

Qualitative consumer research methods can be used to obtain detailed information about consumer attitudes, opinions, perceptions, behaviours, habits, practices and reactions. For this purpose one of the most frequently used qualitative methods is focus group research (Chambers & Smith, 1991; Greenbaum, 1988). Krueger (1994, p.6) defined focus groups as “... a carefully planned discussion designed to obtain perceptions on a defined area of interest in a permissive, non-threatening environment”. The method “is used to determine product attributes that consumers think are important and should be maximised in the product” thus focus groups are the best way to derive the information required for this project; in addition, focus groups enable the researcher to find out about the characteristics that participants do not like and want minimised (Resurreccion, 1998).

Considering all these characteristics the researcher decided to use Focus Groups as one of her methods of collecting data. It was believed that this method is the most suitable one to answer the research questions and achieve its objectives.

3.5.3.1.2. When to use focus groups

Stewart & Shamdasani (1990, p.140) state:

Focus groups are useful for particular purposes and specific situations – for exploring the way particular groups of individuals think and talk about a phenomenon, for generating ideas and for generating diagnostic information. For these purposes, focus groups represent a rigorous scientific method of inquiry.

Focus Groups are a useful way of exploring the new development of a product that may provide a reality check (Marlow, 1987). According to Lawless and Heymann (1998), this method is widely used in marketing research for probing of product concepts and advertising research concerning product presentation and promotion. With these two particular statements, the researcher feels that her selection of the focus group method is supported, since as explained previously, the research has to do with the consumer acceptance of Stevia (a new product) in New Zealand and the description of a product development process designed to achieve this.

Lawless and Heymann, (1998) described how focus groups can be used in sensory evaluation: product development groups that are most often the primary clients of sensory evaluation services may need early consumer input on the direction and outcomes of the newly developed products or variations.

Focus Groups are good for exploration rather than verification (i.e. for finding out what people think about Stevia and Stevia -based products), and for creative stimulation (the researcher has some freedom to organise the session as it best suits him/her) and adding direction and deepening understanding (the researcher guides the session, so only issues of interest are covered). The technique can be used to probe consumer opinion, as well as to explore new product opportunities, to design questionnaires and to examine motivations and attitudes about products (Marlow, 1987 cited in Lawless & Heymann,

1998). The researcher determined that this was the best method for the research because it gave the opportunity of gathering information from a group (that could be selected) in an adequate context.

Krueger (1994) listed the following circumstances when the use of focus group interviews is appropriate:

1. Insights are needed in exploratory or preliminary studies;
2. When there is a communication or understanding gap between groups or categories of people;
3. When there are complicated topics where opinions or attitudes are conditional or where the area of concern relates to multifaceted behaviour or motivation;
4. When the researcher desires ideas to emerge from the group;
5. When the researcher needs additional information to prepare for a large-scale study;
6. When the clients or intended audience place high value on capturing the open-ended comments of the target audience.

Taking into consideration these points, the researcher identified points 1,3,4 and maybe 5 as the reasons for her to choose this method.

3.5.3.1.3. Strengths and weaknesses

There are several advantages when using focus groups to obtain consumer information. However, focus groups have disadvantages as well. To obtain a better understanding of these two possible conditions (see Table 3.3.).

Table 3.3. Advantages and disadvantages when using focus groups as a data collection method (Adapted: Resurreccion,1998)

Advantages	Disadvantages
Flexibility Provides observation of real consumers in an interactive setting Involves fewer participants compared to quantitative methods Can be arranged on short notice and at a lower cost Statistical analysis is unnecessary	Focus group results are not quantitative Sample size is small; results are not projectable Participants do not represent the target market Topics and direction of the discussion are moderator dependent Careful interpretation of the data is crucial

3.5.3.1.4. Participants

Focus groups are typically composed of 6 to 10 people, but the size can range from as few as 4 to a maximum of 12, as Krueger (1994) suggests; he continues by saying that the size is conditioned by two factors: 1) it must be small enough for everyone to have opportunity to share his/her insights and opinions; and 2) large enough to provide diversity of perceptions. Smaller groups afford more opportunity to share ideas and more in-depth perceptions. Smaller groups are easier to accommodate as well.

Krueger (1994) recommends that focus groups should be conducted in a series because they can be influenced by internal or external factors that may cause extraordinary results or chaos. Morgan (1988), suggests that the best advice is to determine a target number of groups in the planning phase, but to be flexible if more groups are needed. The same author also reports that the research goals will determine the choice with regard to the number of groups needed; and that the more homogeneous the groups are in terms of background and role-based perspectives, the fewer groups are needed. Time and money should also be considered when determining the number of groups. Most of the authors think that 3 to 4 groups would be enough; furthermore, they say that when the moderator can anticipate what will be said next in the group, then it is enough. Krueger (1994), suggests that one should continue conducting the interviews until little new information is provided.

Resurreccion (1998) when describing the consumer sampling for focus groups, recommends that the coordinator has to make sure that the participants meet the specifications wanted. Morgan (1988), states “in selecting participants, the issue is sample bias, not generalisability”; he says that 40 or so participants are never going to be representative of a large population.

In this research there were 4 different sessions. Two of the four groups had 6 participants (General Public and Herb Society members), the Diabetics group had 8 participants and the Maori 7. It was planned that each group should have between 6 and 8 persons, but for some unknown reasons some of the participants did not appear on the scheduled day.

3.5.3.1.5. Physical facilities

Resurreccion (1998) briefly presents a list of the facilities that should be considered when organising a focus group.

- Location: the session needs to be held in an area where participants will feel safe; it should be easy to find; sufficient parking should be available and it should be convenient for the participants.
- Focus group room: discussions should be isolated from interference by outside activities and events; the room should also be free from distractions such as telephones, office equipments, noisy lobbies, etc. The room must be large enough to seat participants comfortably but not too large so that participants feel they are in a hall. Lighting should be adequate for reading, writing and examination of products; the temperature should be comfortable and controlled. The room must be clean and free from odours.
- Furnishings must be comfortable and functional. It is recommended that participants sit around a table so that they can have a surface to write on or which to examine products; chairs can be arranged with participants facing each other.

The two first focus groups in this study, were organised in a meeting room in the AgHort Building at Massey University. The room had all the characteristics mentioned above, so it was an ideal place for the discussions.

The two last focus groups were held in different locations. The Diabetes session was held in their location “Manawatu Diabetes Society” rooms because they preferred to do it there. The researcher arrived earlier and arranged tables and chairs as Resurreccion suggested. All the other conditions were met by this location as well. The Maori focus group also was held in a Massey facility, but the facilities were not as they should have been. In conclusion the three first focus groups had a recommended environment, in contrast the fourth fell somewhat short of the recommendations.

3.5.3.1.6. Other considerations

Resurreccion (1998) also identified other important things that should be considered when organising a focus group:

- Structure: ease and informality are the emphases. The focus is to have group dynamics and an in-depth understanding of attitudes, beliefs, opinions, and so on.
- Length of sessions: the sessions usually lasted for one and one-half hours.
- Food: when focus groups are scheduled around a mealtime, it is the custom to provide food for the participants.
- Taping of sessions: sessions should be audio-taped to provide a record of the deliberations that later on will be used in the interpretation of focus groups results and for the preparation of the report. The participants have to be informed of this during the initial part of the session and it would be best if they were to sign a consent form approving it. Often two tape recorders are used to provide back up.
- Props: if the discussion is on food products, have all supplies such as water, napkins, plates, eating and serving utensils ready.

In this respect, all four sessions lasted around 1 hour and one hour and a half. The focus groups had between 5 and 8 participants. All sessions were tape recorded and were planned in the same way.

3.5.3.1.7. Focus Group session

Two different approaches from two different authors are presented as to how to conduct focus groups sessions (Table 3.4.)

Table 3.4. Two approaches of Focus Group procedure

Resurreccion (1998)	Lawless & Heymann (1998)
<ol style="list-style-type: none"> 1. Introduction Phase (10 minutes): <ul style="list-style-type: none"> ➤ Warm up ➤ General purpose and purpose of discussion are described ➤ Objectives are explained ➤ Ground rules: <ul style="list-style-type: none"> - Permission for tape recording is asked - Ask for loud speaking - Participants give their names - Confidentiality ➤ Honest opinions are desired from participants 2. Rapport/reconnaissance phase (10 minutes): <ul style="list-style-type: none"> ➤ Discussion on general issues ➤ Food consumption practices and habits 3. In-depth investigation (40-60 mins.) 4. Closure (10 mins.): <ul style="list-style-type: none"> ➤ Moderator closes the session ➤ Thank you ➤ Distribute incentives 5. Analysis and interpretation 6. Reporting 	<ol style="list-style-type: none"> 1. Introduce self, note ground rules, mention taping 2. Warm up <ul style="list-style-type: none"> ➤ Participants introduce ➤ Talk about the use of the products that will be discussed. 3. General discussion on products category 4. Specific discussion on the product 5. Taste and discuss <ul style="list-style-type: none"> ➤ Pros and cons ➤ Important sensory attributes ➤ Reasons for likes and dislikes 6. Review concept and issues, ask for clarification <ul style="list-style-type: none"> ➤ New products suggestions or variations 7. Close, thanks distribute incentives and dismissal.

Taking these two approaches into consideration, a specific Stevia focus group session was designed for this study, see Table 3.5.

Table 3.5. Stevia Focus Group session details**1) Introduction:**

During the first 10 to 15 minutes of introduction participants first introduced themselves, then a brief presentation of the Stevia plant, Stevia products, Stevia properties, description of the thesis and the purpose of the focus group discussion were given by the researcher. The moderator asked people's permission for tape recording and gave them the rules for the session: loud speaking, not over-talking, give their honest opinion, no interruptions, etc. After that, ethical considerations were discussed, each participant was given an informational sheet (about the entire session and the purpose of the research) to keep and a consent form to fill out and sign.

2) Presentation:

Participants tasted the food and beverages. The facilitator then started to ask the questions. There were 6 main areas covered, and around 10 minutes of time was given for discussions on each. The areas were:

Existence of Stevia

Current sweeteners

Likes about Stevia

Dislikes about Stevia

Preferences in form

Suggestions and opinions

To obtain sufficient information for each of the questions, each question was subdivided into a set of sub-questions. These sub-questions were the milestones for the discussion. An allocation of approximately 3 minutes for each of these sub-questions was given. Interaction between participants was looked at, to have some material back up. This was achieved through: post-it papers (of different colours) classified by the type of answers each participant gave (e.g. likes and dislikes about Stevia), followed by discussions on them.

3) Conclusion:

During the last 10 minutes of closing the discussion participants were asked to answer the written questionnaire (about general issues, for example. age, gender, ethnic group, general sweeteners information/behaviour/ usage).

At the end of the workshop each participant was given a Stevia plant and a Stevia pack containing: a brochure about Stevia (with contact details), information on how to grow Stevia, its history, recipes, medicinal uses, table of conversion, etc., what in technical terms would be the "incentive" for participating.

The topics that were presented in the introduction phase and the structured questions that the researcher asked in each focus group session are presented in Appendix 1.

3.5.3.2. One-on-one Interviews

These are more appropriate for gathering the information of interest; they may be more useful when the issue is very personal, emotionally charged, or if it involves experts who are better probed individually (Lawless & Heymann, 1998). In cases where individuals have a high degree of ego involvement in the topic, they may give more complete information alone than in a group; sometimes the topic in itself lends more comfortably to individual interviews (Lawless & Heymann, 1998). The researcher used this method to gather information on Stevias' current situation in Paraguay and worldwide, and to try to find out what Product Development Process was used in Paraguay in order to develop Stevia and Stevia-based products. Since all interviewees were members of the CAPASTE, but had different roles, the author thought it would be more meaningful to do each interview separately. The one-on-one interviews were done as a complement of the focus groups, to enable the researcher to obtain a deeper understanding of the situation of Stevia and to find out about the Paraguayan experience with Stevia.

3.5.4. Surveys

Bryman (2001, p. 439) considered that many authors use limited quantification in their qualitative research to combat "anecdotalism" by stating:

One of the criticisms that is often levelled against qualitative research is that the publications on which it is based are often anecdotal, giving the reader little guidance as to the prevalence of the issue to which the anecdote refers. The widespread use of brief sequences of conversation, of snippets from interview transcripts, and accounts of encounters between people provide little sense of the prevalence of whatever such items of evidence are supposed to indicate.

Maybe because of this problem, qualitative researchers sometimes undertake a limited amount of quantification of their data (Bryman, 2001).

Patton (1990) stated that quantitative methods require the use of standardized measures so that the varying perspectives and experiences of people can be fitted into a form of

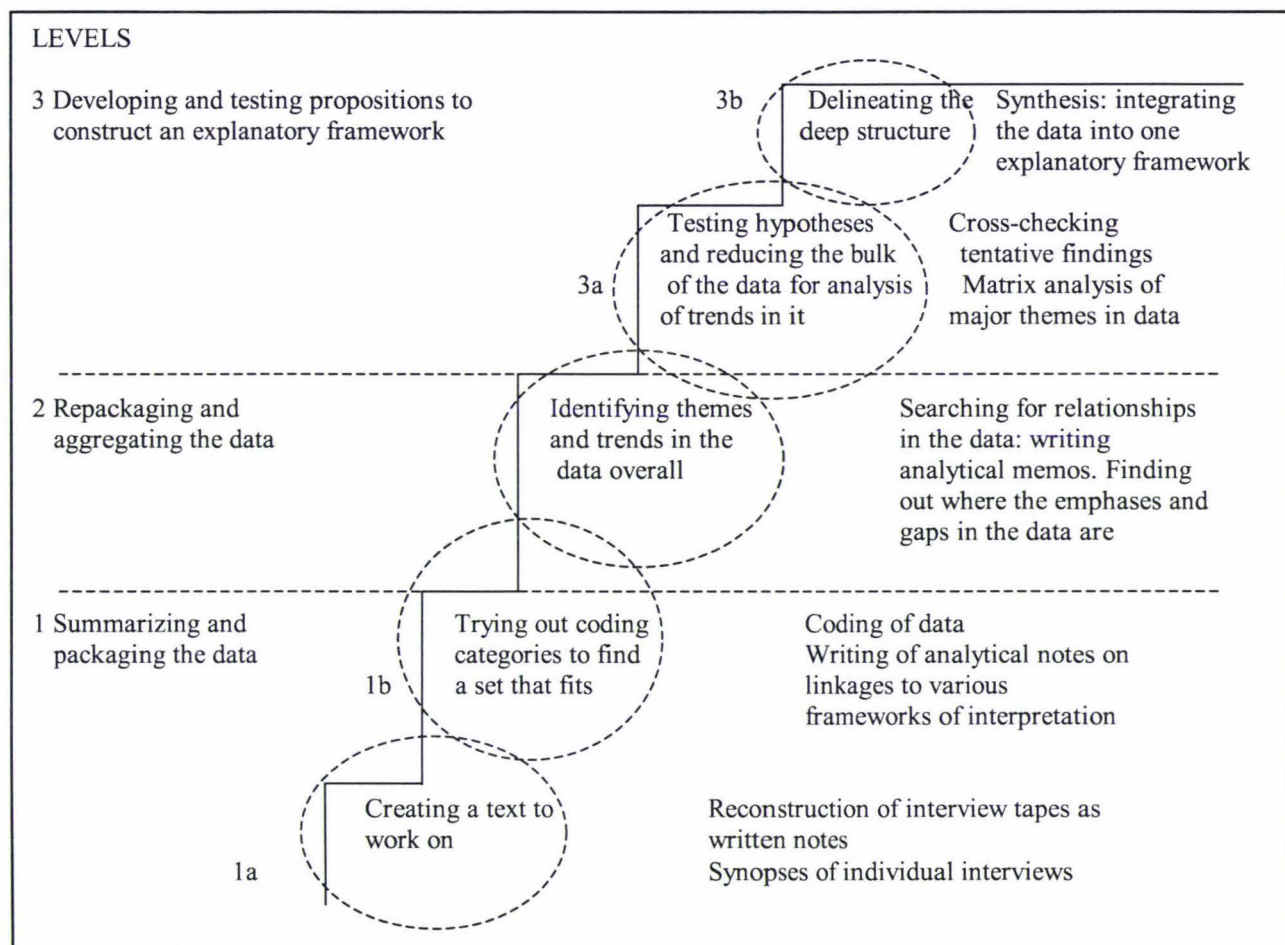
predetermined response categories to which numbers are assigned. This allows comparison and statistical aggregation of the data.

The researcher of this study decided that a limited use of quantitative methods would help to clarify and understand some things better and answer some questions that could not be answered with the qualitative method. Therefore it was decided to use surveys. A questionnaire was designed that included both information on the domain of the survey (the subject) and specific information about participants' current sweetener consumption and potential use of Stevia. The survey covered issues such as: general information about the participants, their current sweetener opinions and preferences, their personal opinions on health and weight concerns, their actual sweetener consumption, the places from which they buy their sweeteners and their opinions about Stevia.

This questionnaire was designed for the focus group participants in order to obtain some additional information from them (see Appendix 2). In total twenty seven completed questionnaires were collected.

3.6. Data Analysis

Once collected, the data must be analysed. The data collected normally takes the form of interview transcripts from a qualitative perspective (Gray, 2002). The data analysis is conducted as if the researcher is telling a story about a specific situation, then constructs a map of the key elements and variables within the story to finally build a theory or model (Gray, 2002). The researcher starts with a text and then codes this into categories before identifying the relationships and themes (Gray, 2002), (see Figure 3.3.).

Figure 3.3. The ladder of analytical abstraction (Source: Carney, 1990)

Patton (1990) wrote that the purpose of the qualitative inquiry is to produce findings; that the process of data collection is not an end in itself and that the culminating activities of the qualitative inquiry are: analysis, interpretation and presentation of the findings. “The challenge is to make sense of massive amounts of data, reduce the volume of information, identify significant patterns and conduct a framework for communicating the essence of what the data reveal (Patton, 1990, p. 371-372).

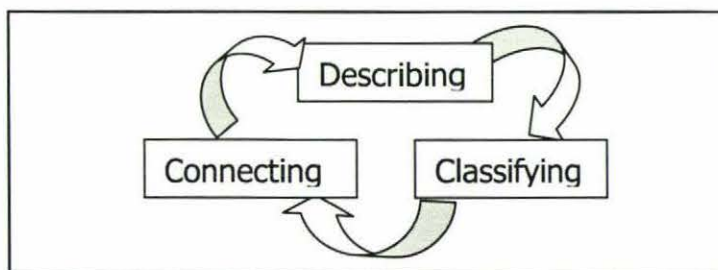
According to Yin (1994, p. 102), “data analysis consists of examining, categorising, tabulating or otherwise recombining the evidence to address the initial propositions of a study”. Every research project should start with a general analytical strategy – defining priorities for what to analyse and why (Yin, 1994).

According to Dey (1993, p.30) the Qualitative Data Analysis “is a process of resolving data into its constituent components to reveal its characteristic elements and structure”, the aim of analysis is mainly to describe the data, the objects and the events to which the data refers (Dey, 1993). Besides describing the data we also want to interpret, explain and understand it; the analysis then, transforms it to something it was not, therefore, without analysis, the data would just be intuitions and impressions (Dey, 1993).

This study used a “within-case” and an “across-case” analysis, suggested by Yin, (1994). The within-case analysis is undertaken for each case in a case study, and it converts the raw data into a case report. Once this has been finished, if it is a multiple-case study, a cross-case analysis is done and the results from each case are compared and contrasted (Gray, 2002).

Simultaneously, the main part of the analysis of this research was done following the circular process proposed by Dey (1993), (see Figure 3.4.), where one can progress from the initial description, through the process of breaking data down into bits (classifying), and seeing how these bits interconnect, to a new outcome based on a re-conceptualisation of the data. The three-step process is iterative and several cycles may be done before the final case report is completed.

Figure 3.4. – QDA as a circular process (Adapted: Dey, 1993)



3.6.1. Description:

This is the first step of the data analysis. The raw data normally come in the form of an interview transcript (see Table 3.6.), which was the case in this study. The purpose of the description phase is to describe the phenomena of interest, provide an overview of

the raw data, highlight important or relevant aspects and maintain the holism of the data (Dey, 1993, Gray, 2002).

The first step in the description process of this study was to read the transcript, correct any errors, highlight important points and make annotations. Then a summary of the content of the transcript (text and diagrams, tables, mind maps) was used. After this, it is suggested that the researcher revises the structure and works through several drafts in order to prepare for the next phase, classification. The summary should contain important information such as the context (it is important as a means of situating action, and getting a wider social and historical import), intentions of the subject, important concepts, relevant explanatory and cause and effect relationships and process models (Dey, 1993, Gray, 2002).

Table 3.6. Example of part of an interview transcription

<p>RESEAR. - So, why would you prefer the powder, is it because the measure thing or what?</p> <p>PARTIC. 1. - One using it in cooking and, its easier to measure, for measuring it.</p> <p>PARTIC. 2- Easier to use, but...</p> <p>PARTIC.3.- Probably because of the tradition in sweets and in cooking, sugar is a dry ingredient.</p>

3.6.2. Classification:

This is the process by which data in the transcript are classified into categories, sub-categories and supra-categories (Dey, 1993). A category is a general idea that stands for a class of objects: that range from physical entities and attitudes to types or classes of cognitive processes (Gray, 2002). Categories must be grounded conceptually and empirically. In this study the sources used to determine the categories were: 1) the data themselves 2) the research questions and objectives, and 3) the relevant theory from the literature. Categories must relate to the wider theoretical context of the study, and the empirical data (Gray, 2001; Dey, 1993). Subcategories and supra-categories were identified as well. The structure of the category hierarchy was done according to the researcher's objectives. The classification process involves iterations between the data and the category name, definition and location in the category hierarchy (Dey, 1993). A

definition sets the boundary around a category and identifies what is in the category and what is not, therefore the more precisely a category is defined; the easier it is to classify the data (Gray, 2002).

The first step in the classification process was reading over the literature review and identifying important concepts and their definitions; next the summary was read to ascertain the concepts identified during the description phase, then the transcript was read line by line and the data were compared to existing concept definitions (Gray, 2002). According to Dey (1993) a data-bit defines a piece of text from the transcript that is an instance of a category; a data-bit may be a word, several words, a sentence, several sentences or a paragraph. However, if the data-bit does not fit into an existing category, and it is relevant to the research, a new category is created and defined. As the data in this research were analysed, categories were redefined, renamed, eliminated, merged, restructured in the hierarchy and/or split and spliced. Dey (1993) said “splitting” refers to refining categories by sub-dividing them into sub-categories and “splicing” refers to the combining of categories (supra-category); the more subcategories are used, the more refined the analysis - but too many categories can lead to unnecessary fragmentation and loss of focus and meaning.

The researcher also tried to make sure that the names of the categories are: appropriate, self-explanatory, theoretically and practically useful (Dey, 1993).

Dey (1993, p. 46) cited some characteristics of the classification phase:

- Classifying involves breaking up data and bringing them together again,
- Classifying the data lays the conceptual foundations for analysis,
- Classification is a familiar process of practical reasoning,
- Categorising and retrieving data provide a basis for comparison,
- Redefining categories can produce more rigorous conceptualisation,
- Classifying should always be guided by research objectives.

3.6.3. Connection:

Once a category hierarchy has been developed, the next step is to identify the connections. During this phase, relationships between categories are identified and then defined. This step is undertaken when the researcher is interested in explanatory or cause and effect relationships or processes (Gray, 2002). It is useful to distinguish between two types of relationships in research: 1) formal or logical relationships that are based on differences and similarities, and 2) substantive relationships that are not based on logic, they have to do with cause and effect “causal”, explanations “explanatory” or sequences of events “chronological” (Gray, 2002, Dey, 1993)

The process of identifying linkages is similar to that of identifying categories; the researcher reads line by line and looks for phrases or terms that link data-bits, for example: *because, but, therefore, and after that, the reason for this...*, and so on (Gray, 2002) . Sometimes links are not stated but are inferred from the context. The presentation of the linkages is as in the classification table; the data-bits are classified under the type of relationship (explanatory, causal or chronological) and defined. It is useful to present the linkages as a model or diagram. Decision trees are a common method used by researchers.

Dey (1993, p. 52) cited some characteristics for the connection phase:

- In classifying we establish logical connections between categories,
- Once categorised, we can look for patterns in the data,
- Statistics can help identify singularities, regularities and variations,
- Regularities can be suggestive - but not conclusive - evidence of connections,
- To establish connections requires a qualitative analysis of capabilities and liabilities,
- Capabilities can be analysed in terms of social structure,
- Graphic representation is useful in analysing concepts and their connections,
- Theories can contribute direction and order to the analysis.

3.6.4. *Within-Case analysis*

The within-case analysis is the first part for the theory building from the cases studied. Once a researcher has finished working through the three steps of the QDA cycle designed by Dey (1993) (describing, classifying and connecting) it may take several iterations until s/he is satisfied with the final outcome, sometimes it may even happen that the researcher has to stop the within-case analysis due to time constraints.

To write the summary Dey (1993) suggests that the hierarchy structure builds the headings and sub-headings of the summary, for example, if there are four major sub-categories below the highest level category, then these will form four high level sub-headings, therefore when presenting a taxonomy, only the levels of the taxonomy relevant to the section that is described and discussed are shown (Gray, 2002).

3.6.5. *Cross-Case analysis*

Miles & Huberman (1994) agreed that the aim of cross-case analysis is to identify processes and outcomes across many cases and to understand how they are qualified by local conditions; further, it enhances the generalisability of the research powerful explanations. A case study that involves literal replication should not be as generalisable as one that involves theoretical replication, this explains why sampling is so critical when undertaking a multiple case study, each case should be chosen for a specific reason (Gray, 2002). Cross-case analysis is also used to deepen understanding and explanation and it allows the researcher to identify under what conditions specific outcomes are likely to occur (Gray, 2002).

The nature of this research is more explorative, and there is only limited existing theory in the field of study, therefore the cross-case analysis compared and contrasted identifying differences and similarities with little or no guidance from existing theory.

When doing a cross-case analysis there are no strict rules, however it is important to develop data displays that will help identify important similarities and differences between cases and to keep in mind that the purpose of it is to identify generic models of

the phenomena under investigation while at the same time identifying differences in case conditions that may lead to different processes or outcomes (Gray, 2002).

The final outcome of this analysis is a discussion about a comparison of the different case studies between each other and with the literature review. Important points are highlighted and discussed.

The researcher analysed the transcriptions of the focus groups. The information was put into data-bits and then categorised as described by Dey (1993).

3.6.6. Quantitative Data Analysis

The numbers versus words contrasts is perhaps the most common belief in many people's minds when they think about the differences between quantitative and qualitative research Bryman (2001a). Qualitative researchers now incorporate research methods associated with quantitative research into their investigations; this means a certain amount of quantification is injected into the research (Bryman, 2001).

Patton (1990) pointed out that "because qualitative and quantitative methods involve differing strengths and weaknesses, they constitute alternative, but not mutually exclusive, strategies for research". One of this study's goals is to investigate selected issues in depth and detail - but as some of the required information cannot be gathered directly, the researcher decided to use surveys to fill the gaps. These were analysed in a very simple mathematical way, using Microsoft Excel.

In order to obtain the best information for this project both methods: - quantitative and qualitative - were used.

CHAPTER FOUR**RESULTS AND DISCUSSION****4 –RESULTS AND DISCUSSION****4.1. Introduction**

The results from the four focus groups are detailed in this chapter. Following this introduction, the next section presents and describes information from each focus group and compares it with information from the literature review. The final part of this chapter presents a “Cross-case” analysis and discussion, where all four focus groups’ results and the literature review are compared and contrasted.

The objective of the focus groups sessions was to get the participants’ opinions about Stevia, to find what the members’ likes and dislikes were, and what advantages and disadvantages they found in comparing Stevia with their current sweeteners. One of the objectives was to see if focus group members would replace their current sweeteners with Stevia. Considering these objectives, the researcher prepared food (sweet cakes: carrot, apple and orange, cookies, buttercookies, and biscuits: oat-biscuits) and beverages (fruit juices: orange and lemonade, coffee and tea) all containing Stevia as the sweetener. As participants had probably not previously tasted products containing Stevia these foods were provided to give them something to consider as a basis for their discussion. A list of prices of some of the products (bought in New Zealand) that were used to prepare the food and beverages, and that were shown to the participants, is given below:

Radiance Stevia – 28.4gm bottle =	23.07 NZD
(90% Steviosides)	
Stevita Stevia Clear Liquid - 40mls =	17.38NZD
Stevita Stevia Powder - 80gms =	23.77NZD
Stevita Stevia Powder – 50 - 1gm sachets =	19.51 NZD

At each focus group members were first asked what-if any-prior knowledge they had of Stevia, what attracted them to it, and whether they would consider replacing their usual sweetener with Stevia. The information derived from the answers to these questions is presented in the first section of the write-up from each focus group. To aid understanding of the information collected from the focus group meetings, participants were asked to give and write their responses under section headings. Four main areas were defined as:

1. Sensory Evaluation, relates principally to the taste, touch and feel of the product it is used in (a formal definition is included in Appendices 3, 4, 5 and 6). Note: the sensory evaluation involved participants sampling various products prepared with Stevia as a sweetener. It is important to note, therefore, that some of the comments could be related not only to the sweetener used but also to the recipe used in preparing that product (see Figure 4.1. and Appendices 7, 8, 9 and 10 Figures A.1., A.5., A.9., and A.13.).
2. Market Issues: in this research only three out of the four Ps of the marketing mix are presented, these are: price, place and product. The fourth (promotion) was neither discussed nor mentioned by any of the participants or the researcher because it was not related to what this research is about. (see Figure 4.1. and Appendices 7, 8, 9 and 10 Figures A.2., A.6., A.10., and A.14.).
3. Health and Research Issues: this area contains some of the concerns about health matters (see Figure 4.1. and Appendices 7, 8, 9 and 10 Figures A.3., A.7., A.11., and A.15.).
4. Convenience: this area refers to the quality of being suitable to one's comfort, purposes, or needs. (see Figure 4.1. and Appendices 7, 8, 9 and 10 Figures A.4., A.8., A.12., and A.16.).

As the level of knowledge about Stevia varied between focus groups a different approach was used for each focus group. Modifications were made to the line of questioning according to the circumstances. Although the same general outline was used in all focus group sessions, different information was obtained from different groups.

The quantitative data analysis that was produced in this research project aimed to give specific and detailed information on the participants. The sample size was not large enough to do any generalisations of the results obtained, as was described in Chapter 3. The questionnaire distributed included information on the domain of the survey (the subject) and specific information about participants' current sweetener consumption and potential use of Stevia. The questionnaire (see Appendix 2) covered issues such as:

- General information about the participants,
- Current sweetener opinions and preferences,
- Personal opinion on health and weight concerns,
- Actual sweetener consumption,
- Place they buy their sweeteners, and
- Participants' opinion about Stevia.

The information analysed quantitatively was to classify:

- The respondents groups, and
- The description of the results of the investigatory analysis.

The responses are summarised in the introduction to the results section for each focus group, in the discussion part of each results section and in the cross-case analysis section.

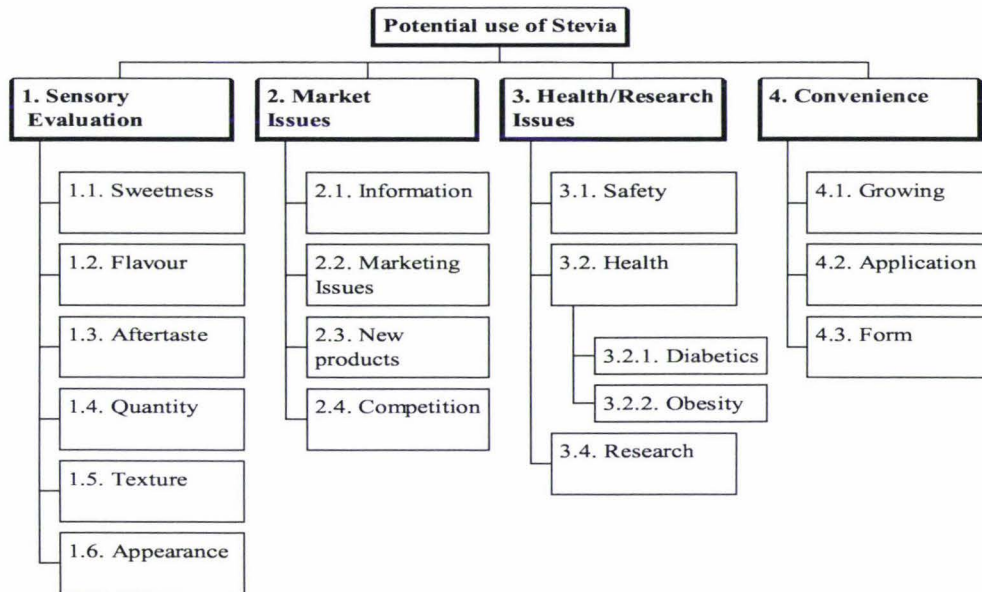
In Figure 4.1 below, the areas defined by the researcher are illustrated. Four sections were specified:

1. Sensory Evaluation
2. Market Issues
3. Health and Research Issues
4. Convenience.

Under each of those sections a range of subsections was defined as a result of the qualitative data analysis process used with focus group responses. Under each of those questions a range of subsections was able to be defined as a result of the qualitative data analysis process used with focus group responses. The subsections were selected in

accordance with the topics which best represent the ideas the respondents wanted to convey. For consistency, the general pattern described in Figure 4.1. is used in the write-ups for all four focus groups.

Figure 4.1. Potential uses of Stevia - classification of the categories and subcategories (shadowed boxes – researcher’s classification; lighter boxes – participants’ answers)



4.2. Results from the General Public Focus Group

This Focus Group was conducted with members of the General Public. Six participants took part in this meeting. They all were New Zealand residents living in the Manawatu area. There were 4 female and 2 male participants (see Appendix 11, Table A.5.). The majority of participants (4) were over 36 years old (see Table A.6. in Appendix 11). There was one participant who was 18 years old or less and another one who was between 26 and 35 years old (see Table A.6. in Appendix 11). Most of the participants in this group were Caucasian (5) and only one was Latin (see Table A.7. in Appendix 11). The researcher acted as the session's facilitator.

Most of the participants (4) in the General Public focus group answered that they like sweet things "moderately"; one of them likes them "very strongly" and the other one likes them "strongly". Half of the participants use sugar substitutes "sometimes" and the other half use them "often" (1), "always" (1) and "never" (1). When asked if they use sweeteners in their beverages, half of the participants answered "sometimes", two of them use them "always" and one uses them "often". Three participants use sugar and sugar substitutes for their cooking and baking, two of them use sugar, and one did not answer to that question. To the question if they go to health shops, 50% of the participants responded that they go "often", two of them go "sometimes" and the other one "never" goes.

The majority of participants in this group did not know about the existence of Stevia before the focus group was held. One participant had read about Stevia in a health and nutrition magazine and another participant grew the plant a few years ago and also knew of a place in Nelson where they utilised Stevia to sweeten bakery products. When asked "what drew their attention when they heard about it?" participants listed things such as: reducing sugar intake - preparing certain drinks (cordial, lemonade) and food without sugar, replacing artificial sweeteners (especially diet soft drinks), getting ready-made products that contain Stevia, consuming something that is sweet and natural and considering that children could consume it too without any harmful effect on their teeth.

Different answers were given to the question “Would you replace your current sweetener with Stevia?” All participants showed interest, most of them said they would try it. However, one participant said she would like to have some more information about the reasons for using it (how to cook with the leaves and how to use it) before answering the question. There was another participant who complained that Stevia is not available in New Zealand. Respondents expressed surprise that they need smaller quantities to sweeten things than are required for sugar. Furthermore, they said that the fact that children can safely consume it too was a good thing. No one answered “no” to the question “Would you be interested in replacing your sweetener with Stevia?”.

The members of the group said they were interested in trying Stevia-sweetened products. Once they had tried each, they said they would decide if they were going to replace their current sweetener with Stevia. A major problem, however, was that the Stevia products required for various foods and beverages are not readily available throughout New Zealand yet.

Having found out about participants’ broad interest in Stevia, specific information required for this research is presented next. Recall Figure 4.1. which will be used as a framework for analysis.

4.2.1. Potential uses of Stevia

To obtain more specific information about Stevia, focus group members’ opinions about sensory evaluation, marketing, health and research, and finally convenience were discussed. The results are presented next.

1. Sensory Evaluation

This part of the analysis deals with the examination and judging of the transmission of impulses from sense organs to nerve centres, especially the taste and touching senses. Following the framework presented in Figure 4.1. the sweetness, flavour, aftertaste, quantity, texture and appearance of products prepared with Stevia is discussed below.

1.1. Sweetness

Sweetness is the property of having a pleasantly sweet taste, the quality or state of being sweet (in any sense of the adjective); gratefulness to the taste or to the smell; agreeableness.

During the whole session respondents used “sweetness” or similar terms many times to describe the way they sensed Stevia. This was the characteristic of Stevia that most caught the attention of participants. However, there were two kinds of reactions: 1) positive responses of participants, such as:

“Very sweet”

“Strong sweetness”

“Amazing strength”

“Extra sweet”

“Sweet”

and 2) another respondent who said the product which was sweetened with Stevia was “*too sweet*”. Although the degree of sweetness differs between people, the majority of participants found the products prepared with Stevia to their liking. Further research would be required to establish quantities of sweetener appropriate to different people’s tastes.

1.2. Flavour

The definition of *flavour* is *that quality of anything which affects the taste; that quality which gratifies the palate*. In the literature some authors have reported that people can taste various flavours in food and beverages prepared with Stevia. At this stage a preliminary assessment of the tastes people associate with Stevia in food and beverages is presented. It is important to note, however, that peoples’ observations about flavour, and later on about texture and appearance of products prepared with Stevia could relate to the particular ingredients used, the recipe, or to the preparation in addition to the characteristics of cooked Stevia.

Here again respondents provided a range of responses, from those who provided positive response such as: “*Very Nice*” and “*Delicious*”, to neutral responses: “*Didn’t get to taste anything abnormal*” and “*Don’t think there is much difference*”; and finally, to negative responses such as: “*Tasteless drink*” and “*Pretty neutral*”. The food was prepared according to the researcher’s taste, hence only general indications can be obtained from these discussions.

1.3. Aftertaste

Aftertaste is a taste persisting in the mouth after the substance that caused it is no longer present. Bearing in mind the comments above about the food’s being prepared to the researcher’s taste, participants in this focus group session had varying opinions about the aftertaste, none of the members of the focus group said the aftertaste was “unpleasant”.

Participants answered negatively in favour of Stevia when asked about the aftertaste. They said:

“*No aftertaste*”

“*I didn’t get to feel an aftertaste*”

“*Just different*”

However, there were two participants who did say something else about the aftertaste. One of them said that it had a “*funny aftertaste*” and another one expressed an opinion that the “*buttercookies had a slight aftertaste*”. Once again, the causes for sensing an aftertaste can be because of the products used, the combination of ingredients, the quantities used, the recipe, and so on.

1.4. Quantity

Participants showed interest in knowing the *quantity* (which is defined as *a specified or indefinite number or amount*) of Stevia necessary to sweeten different food and beverages. They also tried to establish a conversion rate from their current sweeteners to the quantity of Stevia they would require. Their concerns were diminished when they were told that if they use prepared Stevia products a conversion table is usually

presented on the package. For their information a conversion table was presented at the focus group.

1.5. Texture

Texture is defined as *the feel of a surface*. Some participants noticed that the texture of some of the food they were offered was different from what they were used to. They wondered if this was because of the Stevia or because of the recipe, the ingredients or the way that the food had been prepared. The researcher indicated that it might have been the recipe since the same recipe using sugar had similar results to those presented in the session. However, participants said the texture was not bad - it just was different from what they are accustomed to.

1.6. Appearance

This point was not mentioned by the participants of this focus group session. However, in focus groups 2 and 3 this subcategory was discussed.

2. Market Issues

Market Issues are defined as *things related to the world of commercial activities where goods and services are bought and sold*. In this specific focus group session the different issues mentioned or identified are described below and can be seen with more detail in (Appendix 3, Table A.1. point 2).

2.1. Information

Information is defined as *the knowledge derived from study, experience, or instruction*. Participants asked for more information about Stevia and its uses.

When asked about their interest in replacing their current sweetener with Stevia, some participants thought that they would change if they knew more about Stevia, its use and availability.

Researcher - "*Would you replace your current sweetener?*"

Participant - "*Yes I would, but I would probably need some more information and reasons*"

Researcher - *“For example?”*

Participant – *“I mean somewhere where it says how to use it, you might drink it but what about cooking with leaves? You have got the plant, can you take the leaves? How do you refine the plant to use it? What are the requirements?”*

Some participants expressed interest in knowing about the use of processed Stevia in cooking and baking and whether or not it retained its sweetness after cooking. Participants were also interested in the product’s advantages and disadvantages and the use of “raw” Stevia leaves for similar purposes.

2.2. Marketing Issues

Marketing Issues are the commercial functions involved in transferring goods from producer to consumer. As explained at the beginning of this chapter, only three out of the 4 Ps are discussed in this research. In this focus group session issues to do with the price, product and place of Stevia in the market arose.

2.2.1. Price

Price is the amount of money or goods, asked for or given in exchange for something else and it was reported by participants to be an important issue when buying a sweetener. One of the participants was a chef who suggested that when it comes to commercial cooking, the price is an important issue, but if it was for her own use, price does not really matter.

Researcher – *“When you buy your sweetener what do you consider for example, the price, origin, producer? What things do you look at to select one or another sweetener?”*

Participant 1 – *“I think the price”*

Participant 2 – *“Yea, it’s hard to say because I use it a lot, but it’s the price I guess. But like, if it was just like me, then it would depend on the product, that one was good so I’ll take it again, that one lasted longer so, it is worth, and things like that would be meaningful for me when buying a product for me. But, if you ask me for a commercial baking or things like that then probably it would be the price, but for my own use then the product, quality...”*

2.2.2. Product

Product is something *produced by human or mechanical effort or by a natural process*. Participants felt that the nature of the product they use is an important factor in their choices of sweetener. The characteristics of a particular product including its composition and hence the quantity of it required, duration of action and quality are all important. One participant gave an example of this saying: “...*I look at different things, I have found the different brands, you may or may not like that particular brand because of the quality, taste, it goes too quickly...etc., does that make sense?*”

2.2.3. Place

Place is also named *distribution, channel, or intermediary* in the marketing area. A channel of distribution (place) comprises a set of institutions which perform all of the activities utilised to move a product and its title from production to consumption (Bucklin, 1966), place was a common concern amongst the participants because Stevia is not readily available in many places in New Zealand. Participants were interested in knowing where they could get plants and processed products. Most of the participants suggested that there was not easy access to Stevia in New Zealand and that availability plays an important role when they decide which product to buy. For a product to be purchased it has to be in the place where customer shops or expects it to be.

2.3. **New Products**

New products are defined as *not previously experienced or encountered; novel or unfamiliar products*. The researcher identified some of the new products from the context of the focus group, but also from the specific answers of the participants when they were asked to give suggestions of new products that could contain Stevia. The researcher classified the different products into categories (see Table 4.1.)

Table 4.1. New products listed by the participants in the General Public focus group:

New Products	Definition	Suggestions
2.3.1. <u>Drinks</u>	Something you take into the mouth and swallow (a liquid). Drinks are all the beverages that participants suggested could be good products containing Stevia	Cordial, lemonade, soft drinks, juices and hot drinks (tea, coffee)
2.3.2. <u>Bakery</u>	Products such as bread, cake, and pastries are baked or sold	Breads and cookies would be good products containing Stevia.
2.3.3. <u>Sweets</u>	Foods such as candy, pastries, puddings, or preserves	Lollies and chocolate with Stevia, so children could have their candies with not too much concern about dental caries, and other health issues.
2.3.4. <u>Dairy Products</u>	Products made out of milk or its derivatives	No suggestions were given for this category
2.3.5. <u>Others</u>	Different from that or those implied or specified before	Rhubarb, sauces and cereals

Participants in this focus group had a wide range of new products ideas, and covered four out of the five categories. Amongst the drinks they listed juices, soft drinks, hot drinks and others. Examples of baked goods were breads and cookies and of sweets; lollies and chocolate. They did not give any ideas for dairy products, and they believed rhubarb, sauces and cereals would be good products to contain Stevia.

2.4. Competition

Competition is where one competes with others, a rival - and for this research the competing products identified by participants are sugar and the artificial sweeteners: saccharin, aspartame and cyclamate.

Most participants in this group said they use sugar as their sweetener, especially for cooking, baking and making drinks. They reported using white sugar, castor sugar, icing sugar and brown sugar (see Appendix 3, Table A.1., point 2.4.1.)

Some participants were worried about the use of artificial sweeteners because they were aware of the side effects and/or complications these sweeteners can cause when they are consumed. One participant believed that saccharin and cyclamate cause cancer. Another participant mentioned some problems with aspartame. Many participants agreed that

artificial sweeteners are not good for cooking or baking and that most of them are not safe. One of the participants also commented “... *I read something that children should not be given Nutrasweet because it puts back the growth*”.

Another point mentioned during this meeting is that 20 to 30 years ago, artificial sweeteners were very expensive and that with lots of advertisement (especially of Diet Coke) and market pressure, they dominated the sweetener market for almost all diet foods or drinks, if somebody wanted to buy them 10 years ago, that was almost impossible because they were too expensive and not known. This comment was made in an attempt to compare the current situation of Stevia with the past situation of the artificial sweeteners, and a further comment was that if Stevia uses the same channels of advertisement it may succeed in the near future.

3. Health and Research Issues

Health and Research Issues are things related to the soundness of body or mind; freedom from disease or abnormality; and related to scholarly or scientific investigation or inquiry. These two categories (health and safety), were discussed in the focus group session, because they are considered areas of general interest and the participants wanted to know more about them.

3.1. Safety Issues

The participants of this focus group did not mention anything about Safety issues.

3.2. Health Issues

The researcher developed understanding of the health concerns during the focus group session. These concerns related to the fact that sugar has calories and it is perceived to be bad for people. Participants thought that if Stevia could replace sugar in cooking, baking and in preparing drinks it would be a healthier choice. Participants felt that being a natural product with some medicinal properties which provided sweetness with no calories, Stevia would be an ideal product. The fact that children could get sweet products without risking their health was seen as a further incentive for the use of Stevia.

3.2.1. Diabetes Issues

Although none of the participants in this focus group were diabetics the members all recognised that the product would be of immense value for diabetics. Participants in this workshop were interested to know “*what the attitude of diabetics was towards the product*”. They were interested to know if the product is recommended or available to diabetics as they felt that the replacement of artificial sweeteners with a natural, healthy product was an excellent idea. “*Do they recommend it at all? Do they know it?*”, showing concerns towards that group of people. They suggested that after all they have learned and heard about, the diabetics are a potential market for Stevia because until now they are allowed to use only artificial sweeteners and these are not safe, they said. “*A natural sweetener would be good for them*”.

3.2.2. Obesity Issues

Participants talked about the benefits Stevia would provide if sugar intake could be reduced. They did not refer specifically to issues of obesity.

3.3. **Research Issues**

Apart from the need for information, members of this group did not raise any issues to do with the need for research into the use of Stevia as a sweetener.

4. **Convenience**

Convenience is the *quality of being suitable to one's comfort, purposes, or needs*. The researcher found this name useful for classifying general interests of the participants about Stevia. Under this category three main issues are analysed: growing, application and form.

4.1. **Growing**

Growing is to *allow (something) to develop or increase by a natural process*. Although this was not the real focus of this research, participants sought information about several issues to do with growing Stevia. However, as participants were given a Stevia plant as part of an acknowledgement of their assistance in the project, they were provided with

basic recommendation for maintaining it. As a result participants wanted to find out more about culture of the crop, and interest was shown in plant propagation, container culture and final plant size.

4.2. Application

Application is the *act of putting something to a special use or purpose*. Participants were extremely interested in the wide range of uses for Stevia and Stevia-based products in world markets.

4.3. Form

Form is the *shape and structure of an object*. Different forms are available for different applications. Participants discussed this issue in the session and agreed that they would use the powder form most of the time if it were available. The reason for this was that in this form it is more like sugar than when it is available as a dried leaf.

Some participants agreed that the liquid extract could be used in drinks - but not for baking because they felt it would be hard to measure accurately. They also suggested that it would be easy to use and that it appears to be very strong/concentrated in this form. However they specified that this would not be their preferred form if they had to choose as they are accustomed to dealing with sweeteners in solid form.

Some of the participants were more interested in the plant. They said it is 100% natural, it is healthier and cheaper than other sweeteners. The interested people wanted to know about the process of drying the leaves, and were also interested in using the leaf form as a skin tonic.

During this session there was no one who considered forms of Stevia other than those which were presented at the session. Some participants felt they would use a range of products according to their needs.

4.2.2. Discussion

The general public group showed a positive response towards the introduction of Stevia into New Zealand. Participants in this group were interested in almost all areas concerning Stevia. Table 4.2. gives some information about the participants' health and weight concerns, and about specific information related to their consumption of sweeteners.

Table 4.2. General context of the general public's attitude towards sweeteners

Questions	Yes	No	Did not answer
Are you a health conscious person?	6	0	0
Do you worry about your weight?	6	0	0
Does your current sweetener have an aftertaste?	1	4	1
Do you buy your sweeteners in health shops?	0	6	0
Do you buy your sweeteners in the supermarket?	6	0	0
Do you like the snacks you tried?	6	0	0
Do you like the beverages you had?	6	0	0
Did you feel an aftertaste?	2	4	0
Would you sweeten your foods and beverages with Stevia?	5	1	0

As can be observed in Table 4.2. all participants answered that they are health conscious and that they do worry about their weight. When asked where they buy their sweeteners all of them replied "in the supermarket". Four of the participants said that they do not feel an aftertaste in their current sweeteners, which could be explained with the fact that they use sugar as their main sweetener. The same number also said that there was no aftertaste in the food and beverages prepared with Stevia, which agrees with the answers participants gave during the session where two of the participants reported sensing a "funny" and "slight" aftertaste (respectively) in the cookies. All of the participants answered that they liked the food and drinks prepared with Stevia-based products, which disagrees in some respect with two of the answers given during the session, where two participants said that one of the drinks was "tasteless" and another one said it was "pretty neutral". Five participants in this group said that they would like to sweeten their food and beverages with Stevia.

The participants in this group agreed that they would like to try Stevia as a sweetener and then decide if they would replace their current sweeteners with it. Their reactions can be taken as being positive, but as the majority of people do, they did want to have more information on Stevia. There were no negative answers for the question “would you replace your current sweeteners with Stevia?”

Comparing their attitudes with the literature, there is not much difference, since after hearing and/or reading all the benefits Stevia has, most people are interested in trying it, and some are willing to change from their current sweeteners to it. The problem statement of this research is backed up by the answers of this group. One part of the objectives and questions can also be answered with the results of this section.

All the participants of this focus group agreed about the sweetness of Stevia, although this issue is subjective since there are many variables that have an influence on it. This group did think Stevia was very sweet; but one participant even thought it was “*too sweet*”. When comparing them with the literature, the views of participants concurred with the viewpoint of authors. This agrees with the first recorded written description by M.S. Bertoni that states ““In placing in the mouth the smallest particle of any portion of the leaf or twig, one is surprised at the strange and extreme sweetness contained therein”. However, there are some cultures or groups that like their food and drinks sweeter than do others; in these cases a little more of the product would be needed (as with any other sweetener).

There is no literature about New Zealanders’ reactions to the flavour of Stevia. As explained previously, comparisons are made with the literature available (most of it from the USA). As this is another subjective area, there are different opinions on this issue – there are those who think it has a “nice”, “good”, “tasteful” taste and those who think it is “bitter”, “sour” or “tasteless”. It is important to clarify that the researcher prepared some special recipes that cannot be found in any other source. Therefore comparisons are difficult, but the results of this focus group are close to the expressions in the literature where different opinions were given: those who liked it, those who thought it had nothing special, and those who did not like the flavour.

According to the literature, the aftertaste is one of the main concerns for Stevia's introduction as a sweetener. In its natural form this will continue for those who can taste it, but with the processed products of Stevia nowadays technology is improving the methods of extraction and the "known" aftertaste seems to be disappearing. It is important to mention that the aftertaste is said to be dependent on the manufacturer as well; there are products of lesser quality, which seem to have a stronger aftertaste, and some products that do not have an aftertaste at all (Pilger, 2002). The quantity used is also an important variable when it comes to feeling an aftertaste, usually if more than is needed is used, the food or drink leaves an aftertaste (this not only happens with Stevia but also with many other sweeteners or condiments).

Another major concern amongst both the participants in this focus group and the literature is the quantity. It is still not well known how to convert Stevia quantities into sugar quantities for example. There is also the fact that there are different kinds of products of the same form with different quantities of Stevioside or Rebaudioside which makes the conversion more difficult. However, there are some tables of conversion available and many of the products have the conversion on the labels, which help to overcome this problem.

The texture matter is again a subjective area. The researcher noticed that the recipes used were not common in New Zealand, therefore some of the comments about the texture could not be taken as a Stevia problem or issue. The literature does not highlight any texture concerns in this respect.

The need for more information is reflected in the number of focus group participants who wanted to find out more about Stevia. The main areas of interest were: Stevia uses, cooking, properties, price, product characteristics, places of supply, growing issues, different applications, and forms, interests that are also common in the different literature found.

Respondents in this session considered the price an important issue when buying their sweeteners. The price issue is one of the main constraints for Stevia to become a widely

accepted sweetener. According to some market research done in Paraguay, Argentina and Brazil, findings showed that most people who consume Stevia are health conscious people, people who have diabetes, and weight watchers, who are willing to pay a little more for a natural occurring sweetener (J.C. Fischer, personal communication, 26 December, 2002). Organic consumers are also after this relatively new sweetener which can be grown organically without major problems. These market segments show us that they are more concerned about the actual product than its price. One advantage Stevia presents over other sweeteners is that it can be grown; people have that option and do not necessarily have to buy expensive products. The participants in this group did in that sense consider the possibility of growing their own sweetener a good option.

The place is an issue participants mentioned as being a constraint for them, because of the limited availability of the product. This is a marketing rule: that the product has to be in the place where the consumer can get it. In New Zealand, Stevia is not offered in many places yet, but with an increasing demand this may change according to the supply and demand law.

This general public focus group suggested that Stevia could be added to products such as: drinks (cordial, juices, soft drinks, hot drinks); bakery (breads and cookies); sweets (lollies, chocolates); others (rhubarb, sauces, cereals), some of these products are available in some countries already. As can be noticed there are no restrictions in the kind of food or drinks they cited, which demonstrates that they are a general public group.

Promoters of Stevia (Bonvie, L., Bonvie, B. & Gates, 1997; Cassani, 2000) highlight the different and many negative effects artificial sweeteners cause to human beings; in this respect they promote Stevia as a natural and healthy alternative. Participants in the focus group were aware of the problems artificial sweeteners are causing and most of them said they use sugar in its various forms as their sweeteners, because of the bad comments about artificial sweeteners; in this case Stevia's competitor then would be sugar. Participants listed some of the disadvantages sugar has and in that respect they agreed upon the advantages Stevia has.

The fact that researchers or authorities in some countries (especially the USA) suggest that there has not been sufficient research and proof (Gold, 1995) to demonstrate that Stevia can be considered a safe food, makes many people unsure about consuming Stevia. On the other side, there are those who present a considerable amount of proof – that Stevia is safe and claim that there has been ample research (Chan, Tomlinson, Chen, Liu, Hsie & Cheng, 2000; Fujita & Edahiro, 1979; Geuns, 2000; Suttajit, Vinitketkaumnue, Meevatee, Buddhasukh, 1993; Yabu et al., 1977) that have no negative results. Participants asked the facilitator about health and research issues as almost everybody else who is introduced to the Stevia world does. Participants from the general public immediately related Stevia to diabetes, and suggested this group of people would get many benefits out of this plant.

As mentioned already, there were several questions about the growing, application and different forms of Stevia, as is very common amongst people who start finding out about this herb. Participants were given explanations and recommendations for growing the plant as well as for the different uses Stevia has (in its natural form and/or processed form). They were especially interested in the cooking and baking issues. Most participants agreed that they would prefer the powder form because it is more like sugar and easier to use and measure. In most Stevia books and Stevia web-sites a reader can get all the answers to the questions considered by this group, therefore the researcher describes this group as a typical group of potential consumers interested in finding out about the product.

4.3. Results from the Herb Experts Focus Group

The second focus group comprised members of the Manawatu Herb Society. Six members took part in this meeting. In addition to being interested in herbs all were New Zealand residents living in the Manawatu area. There were 5 female participants and only one male. Fifty percent of the participants were within the age range of 36 –50 years old, and the other 50% were 50 years or older. The ethnicity distribution was as follows: four participants were Caucasian, one of the participants was Maori and the last one was Latin. The facilitator contacted one of the members who took a “sign in” paper to one of the Society meetings, and those who signed were contacted and recruited.

Most of the herb experts (5) answered that they like sweet things “moderately”; and one likes them “very strongly”. Half of the participants use sugar substitutes “sometimes”, two of them use them “always” and the last one “never”. When asked if they use sweeteners in their beverages, half of the herb experts answered “sometimes”, two respondents use them “always” and the other respondent does not use them. Four of the participants of this group use only sugar for their cooking and baking, and the other two use sugar and sugar substitutes. To the question asking if they go to health shops, four go “sometimes”, one of the participants responded that she goes “often” and the other one does not go at all.

Four of the six participants in this group did know about the existence of Stevia before the focus group meeting. Two of them had attended a talk on Stevia in one of their society meetings. Another one had read about it and bought a plant, while the last one recalled she had heard “a lot” about Stevia, and so she also bought a plant. When the participants were asked “what caught their attention when they heard about it?” participants mentioned the following things:

- *“The fact that you didn’t have to use sugar; that you actually could cut down on sugar.”*
- *“Just mainly because the same, because of health, and I was interested in growing some sort of crop. Still interested in growing some sort of crop.”*

- *“Yes, it sounds so good, a natural way of sweetening your food. Grow your own sugar in the garden.”*
- *“She said that it was fairly good for the skin as well. For wounds”*

To the question, “Would you replace your current sweetener with Stevia?”, participants responded with different points of view. All of them replied they would try, but they also made some suggestions. One of the participants said she would be happy changing but she also explained that her family had lactose intolerances; therefore products that contained lactose as fillers would not be her option.

This group’s participants said that they are all interested in replacing their current sweetener with Stevia, however they mentioned two different ways of doing it. Firstly, the leaves and secondly the processed Stevia.

Another participant admitted that he “really likes the idea” of replacing his sweeteners with Stevia. Given the two options, the Stevia plant itself or the Stevia-based products, participants discussed with which of these options they would replace their sweetener. Some of them agreed that they would prefer to buy the processed products, without discarding the idea of using the green form. Some negative points mentioned about using the green form were that some people (especially children) might not like the appearance of the food and the remaining pieces of the leaves (see the part of a transcript below). Others, on the contrary, stated they would prefer to have it “green” and have “reusable” ingredients.

“See I was thinking of a baking point of view because I have children and... so that’s why I’d like the white [powder] because of baking. Green flecks [of the leaves] through the shortbread mightn’t go down”.

In the same way as in the previous focus group the framework presented in Figure 4.1. is used as a basis for discussion of the factors affecting the use of Stevia by herb experts. This discussion is presented in the following section. Rather than repeating the definitions and explanations of them the results alone are discussed.

4.3.1. Potential uses of Stevia

As members of this focus group were aware of Stevia and its potential the issues discussed with this group were far more detailed than those discussed with the members of the general public.

1. Sensory Evaluation

The sensory evaluation was conducted in the same way as for members of the general public using food prepared in exactly the same way. (It was felt that although some members of the general public focus group did not like aspects of the food presented to them there were not enough of them to warrant a change in the recipes).

1.1. Sweetness

After trying the different food and beverages, participants agreed on the sweetness of the food prepared with Stevia. There was only one person who said *“It’s sweet, but it’s not that sweet”*. Everybody else was referring to the sweetness of the cooking sweetened with Stevia, as being *“really strong”*, *“very sweet”*. When they were told how little Stevia was used they remarked how surprised they were at how little is needed to achieve such sweetness.

There was one participant who wanted to drink a cup of tea sweetened with Stevia, so he took a leaf and prepared the drink. His comments about it were:

“I had five cups of tea and two leaves and it still tastes like the first one.”

“And on the third one I actually took a piece of the leaf and chewed it, and it’s very sweet.”

1.2. Flavour

This characteristic relies mainly on the taste of the participants. Participants had more than one way of describing this characteristic: they said the food prepared with Stevia has more flavour in it than they thought, that the flavour was nice, refreshing, good, lovely, very pleasant, and so on. These answers, however, may also relate to the cooking or the recipe, not only to the fact the food was sweetened with Stevia. Some

participants also compared the flavour of Stevia with sugar, and they affirmed that it tasted like sugar, that there was no difference. Two of the participants said:

“I mean I could serve those up to my kids and they would eat that quite happily and think it’s sugar.” and

“I think that it would be a pretty good connoisseur that would pick the difference...”

There was only one negative comment on flavour which was “with the coffee it is basically tasteless”, in which case it can be taken either that it is really so, or that the coffee was too strong.

1.3. Aftertaste

Members of the group expressed a wide range of opinions about aftertaste in the cooking from those who did not feel an aftertaste:

from

“I don’t think it had that aftertaste”

“I found it quite – the orange there was no aftertaste – it was just like an ordinary juice.”

to those who felt an aftertaste and either liked it or did not object to it:

“It’s pleasant though. It’s pleasant isn’t it?”

“Not unpleasant, but ...”

to those who sensed an aftertaste and found it unpleasant:

“To me it tastes like it has a slight aftertaste. Would that be the Stevia? “

“Well I thought the lemon juice and the carrot had a more instant aftertaste. Now I tend to feel that it’s a combination of other things – the amount....”

“I felt that with the lemon drink it was very much an aftertaste and I watered down and it disappeared.”

Having three kinds of answers for this issue demonstrates that the aftertaste is a subjective area where the sense of taste plays an important role. From the answers given

by the participants it can be assumed that the aftertaste also depends on other issues and not only the actual taste, for example the amounts used, the brand, the food or specific beverage it was used in, etc.

1.4. Quantity

In the same way as for members of the general public members of this group wanted to know how much to use. They felt that in order to change from their current sweetener to Stevia they would need to be able to work out how much to use and would also need to practice using Stevia.

1.5. Texture

The texture of the food prepared with Stevia products was different from what some of the participants are used to; this could be because of the recipe, the cooking or because of the amount of Stevia used (which in volume represents a lot less than the amount of sugar required). But there were also some of the participants who compared the food with what they cook or bake and they said there was not much difference, for example:

*“I probably would do a cookie that would end up sort of like that anyway”, or
“The texture is very, very similar”.*

1.6. Appearance

Appearance is the outward or visible aspect of a thing or person. Appearance was an issue for the participants in this focus group. They especially mentioned the “colour”, and wondered if Stevia changes the colour of the drinks or if this had been caused by the fillers. They also mentioned something about using the leaves to sweeten things, and observed that some people (especially children) might not like the green colour – or different colour in their food. However, there was one participant who believed it could be exciting for children to see something different.

2. Market Issues

Because members of this group were aware of the existence of Stevia there were major differences between the issues raised in this section and those raised by members of the general public.

2.1. Information

Participants were interested in knowing about the extraction methods and the extraction process for Stevia. A discussion on the fillers used to make processed products easier to use was held as well; participants wanted to know what fillers were used, how they react, and so on. They also wanted to know how Stevia reacts when mixed with other flavours. Finally, they were interested in knowing if children can consume Stevia.

2.2. Marketing Issues

Price, product and place were again raised as issues by members of this group.

2.2.1. Price

This group did not think that the price plays an important role when buying their sweeteners. They answered that it does not really matter. One of the participants said in this respect: *“So probably even if it was a little more expensive than sugar it is worth it. Because it is small what you use”*. In this sense, as was explained in the literature review, the conversion of sugar into Stevia depends on the form in which it will be used. If the leaves are used it has to be considered that they are 10 to 15 times sweeter than sugar; if the extracts are used, the range can go from 100 to 300 times sweeter than sugar, depending on the form, brand and products used.

2.2.2. Product

Most of the participants in this group said that when buying a sweetener they look more at the characteristics of the product, and for what they actually need in that moment, as for example:

- 1) *“...it has to make you happy”*,
- 2) *“...so I bounce between quality and the cost”*,
- 3) *“My only concern would be if they had put lactose in it”*,
- 4) *“...because I like them or because they are good for me or I am after a healthy diet for me and my family”*,
- 5) *“...the choice could be taste, quality”*.

These quotations refer to some of the characteristics participants find to be important when buying a product (sweetener). This group of people is said to be one that cares more about health, well being, and one that chooses natural and/or organic food if possible. This situation is something considered to be not very common yet since the majority of people care more about the price.

2.2.3. Place

As participants in this focus group are more aware of the health shops and places where different herbs are sold, they knew where to get Stevia. However, some of them did bring up this issue, asking where the products were from, which implies their concern about getting them or knowing the origin of the products presented in the session.

2.3. New Products

In addition to the products identified by the general public group, members of this group identified additional products that could contain Stevia. Presumably, both their knowledge of the plant and their interest in herbs enabled them to provide this wide range. The researcher identified some of the new products from the context of the focus group, but also from the specific answers of the participants when they were asked to give ideas of new products that could contain Stevia. The new products that were identified in this focus group are listed in Table 4.3.

Table 4.3. New products listed by the participants of the Herb Experts focus group:

New Products	Definition	Suggestions
2.3.1. <u>Drinks</u>	Something you take into the mouth and swallow (a liquid). Drinks are all the beverages that participants suggested could be a good product containing Stevia	Fruit drinks, children drinks
2.3.2. <u>Bakery</u>	Products such as bread, cake, and pastries are baked or sold	Biscuits, pastry
2.3.3. <u>Sweets</u>	Foods, such as candy, pastries, puddings, or preserves	Preserves, Gummy bear type of things, chewing gums, bubble gums
2.3.4. <u>Dairy Products</u>	Products made out of milk or its derivatives	Ice-cream
2.3.5. <u>Others</u>	Different from that or those implied or specified before	Jam, drink sachets, toothpaste, skin products, vitamin C tablets. End products for diabetics

The new products listed by this group of people coincided in only two products with those suggested by the previous focus group: cordial and lemonade. All other ideas were different. They suggested that fruit drinks and drinks for children would be good; they also suggested pastry and biscuits and many sweets including chewing gum, bubble gum, preserves, gummy bear, and so on. One of the members suggested that ice-cream would be a great idea and a variety of other products such as jam, drink sachets, toothpaste, skin products, vitamin C tablets and products for diabetics were listed.

2.4. Competition

Members of this group identified three major competing products being sugar, artificial sweeteners and honey.

Not unexpectedly - given this group's knowledge of Stevia along with its benefits and disadvantages - participants were able to describe some reasons why sugar has advantages over Stevia. These were that sugar is crunchy, sugar can caramelise, you can bake breads with it and you can prepare jams. They were not very sure if all of these would be possible with Stevia.

The participants in this focus group gave no specific names or formulas for artificial sweeteners. However, one of the participants insisted that when a person changes a product for an alternative one, it always tastes different at the beginning, but then one gets used to it. She gave the example of the aftertaste, which is noticed by people trying artificial sweeteners for the first time which regular users no longer comment on.

3. Health and Research Issues

For many undefined reasons members of this focus group reported upon a wide range of health and research issues to do with using Stevia. Amongst the different issues of interest, participants asked about the regular intake of Stevia. Another participant compared Stevia's situation with the organically grown goods. He said that the people who do not consume organic products do not really know about the differences and

different alternatives available, they are more concerned about other things - such as, for example, the price. This is the case for sugar consumers for example.

3.1. Safety Issues

One of the participants (interested in Stevia as a medicine for the immune system) wanted to know what the recommended amount for children was, and if it is safe according to medical advice.

3.2. Health Issues

Participants in this focus group liked the idea of having *“a natural way of sweetening your food”*. One of the participants suggested that if some mass consumed products, such as biscuits, contained Stevia the general public’s health would improve. Related to this, another participant stated that *“Stevia would be most beneficial to New Zealand and children with no sugar”*, meaning that if the population and the children of New Zealand were to consume Stevia instead of sugar they would improve their health and well being. Two other participants pointed out that they consider Stevia to be a good thing because it replaces the sugar intake. They said:

“...actually cut down on sugar” and

“...because of health, ...and it replaces the sugar intake”.

Another participant expressed another point of view for this issue. She suggested that Stevia could be *“a good thing for children who are hyperactive”*, because sugar has a bad effect on this, she said. Finally, someone felt that because Stevia contains vitamins it is simply *“miles better for you”*.

3.2.1. Diabetes issues

One of the participants of this focus group was Maori and he reported that there is a high rate of diabetes amongst Maori. He believes Maori like to eat and drink a lot of sweet food and drinks. To this someone else added that *“...they did statistics on diabetes in Maori, I think it was last week they did a report on it where they are so much higher, about forty percent higher than in Europeans, that’s a fact, especially in the males it seems to be.”* Participants in this group said that the diabetics were a

potential market for Stevia and Stevia-based products, since it would be very beneficial for them. They suggested that end products for diabetics (containing Stevia) would be good.

3.2.2. Obesity issues

The participants of this group did not mention anything about the obesity issues.

3.3. Research issues

Focus group members had a range of interest in research about Stevia, from general to specific. Participants in this group wanted to know about some recent research published about Stevia and if there are recent results. There was one participant who specifically asked about research done on “candida”; she showed interest in finding out more about Stevia and the prevention of the growth of candida. Another participant wanted to know about research she had heard was being conducted about the consumption of Stevia sweeteners by children.

4. Convenience

As in the first focus group, the three main categories analysed here are growing, application and form.

4.1. Growing

Since this is a group of herb experts it is understandable that they were very interested in knowing more about the growing part of Stevia. Participants indicated that some time ago there had been somebody interested in growing Stevia as a crop in Wanganui (a nearby district), but that the project did not progress because of the frost susceptibility of the crop. One of the participants also revealed that she was interested in growing some sort of crop and that she still is. Many participants liked the idea of “*growing your own sugar in the garden*”.

One of the participants asked about the possibility of growing Stevia in coastal areas where there usually is no frost, and s/he were also interested in how long s/he could keep the dried leaves.

Participants asked about when the crop flowered and how to propagate it from cuttings. In addition to answering these questions the researcher was able to discuss propagation from seed.

As some of the participants already had a Stevia plant before attending the workshop and the rest of them were given a plant all members wanted to know about caring for Stevia plants. Some of the questions they asked were about the climatic conditions the plant requires to grow, frost, temperature, topping them in winter, and the need for using crop covers for over winter outdoor crops. Focus group members were interested to know about the ways in which Stevia is grown overseas.

Participants showed interest in finding out in what different ways Stevia could be grown. One of the participants asked: *“Has anybody looked at hydroponically growing it?”*; while a further one asked about the potential for production of Stevia as a greenhouse crop.

As in the previous focus group members of this focus group also asked questions about the size of the Stevia plant. One participant wanted to know if it can be grown in pots and if it is a shrub.

4.2. Application

Participants were interested in knowing the different ways and forms in which Stevia can be applied. They asked about the use of Stevia in food/beverages and as a lotion for the skin. They also wanted to get more details on the use of the processed products.

4.2.1. Plant

The researcher listed the different uses of the plant. Most participants in this group wanted to know about using the leaves as a sweetening agent for food and beverages and as a herb tea on its own. They insisted on finding out how many times one leaf could be used for the herbal tea. They were surprised when one of the participants used the same leaf for three different cups of hot water and that after that he said that the leaf

still tasted sweet. One participant shared her thought of using the leaf for dipping, or boiling it with water to preserve things. Another participant replied that it would be good to prepare sugar syrup with Stevia, which could be then used for cooking fruit.

Participants also wanted to find out more about the application of the leaves on wounds or the skin. They first asked the researcher how to prepare the lotion and then how to apply it. Those people who had been aware of Stevia before the focus group session thought about a great many more uses for Stevia than did people who had been unaware of its existence prior to the focus group session.

4.2.2. Processed products

Most of the participants wanted to know which Stevia based product is used for baking. They said they would “*love to bake*” with Stevia, and that “*I’d [the participant] love to experiment*”. They suggested that for the baking specifically they would use the powder or bulk.

4.3. Form

The different forms available have different applications. Some of the participants were not aware of the different forms available. Although most of them knew about the plant, few knew about the processed products. There was considerable discussion amongst participants when deciding which form was best in various situations.

4.3.1. Powder

All six participants agreed that they would prefer the powder form. They listed a number of different issues to come up with those decisions that are shown in the box below.

Participant 1: “*I think that given the white powder is advantageous. Myself, I wouldn’t worry, but I do find as you say for children.*”

Participant 2: “*...for my guests I would use the powder, it’s more like sugar, more appropriate.*”

Participant 3: “*I find it lovely. I certainly will use it.*”

Participant 4: “*I’d probably have the powder if I had to choose*”

4.3.2. Liquid extract

The participants in this group were not very interested in the liquid extract; one of the participants said that she would get confused using the liquid extract and the powder and that it would take her more time to get used to it than she would need to get used to using powder which is close to sugar in its use.

4.3.3. Plant

All participants admitted that they would be interested in using the plant directly. Most of them said that they had no problems with the thought of leaf remaining in their food and drinks. They recognised that children might not feel this way. Some of their statements are shown below.

Participant 1: *"I probably like the idea of green and, say, reusable ingredients."*

Participant 2: *"I am thinking I probably will use the plant. But it doesn't bother me to see the green leaves"*

Participant 3: *"...but then I would certainly invest in trying and experimenting with the plant and go out and take some leaves instead of going to the shop."*

Most participants stated that they would be happy using both the powder and the plant. In this case it would be a combination, since they said if it was for themselves they would just use the plant, but that if they had children or guests they would use the white powder. One of the participants declared he would like to be *"completely organic"*.

4.3.4. Others

No other forms of Stevia-processed products were mentioned in this focus group session.

4.3.2. Discussion

As in the previous focus group, a table with some more information about the participants' sweetening habits is shown below (Table 4.4.)

Table 4.4. General context of the herb experts' attitude towards sweeteners

Questions	Yes	No	Did not answer
Are you a health conscious person?	6	0	0
Do you worry about your weight?	4	2	0
Does your current sweetener have an aftertaste?	2	4	0
Do you buy your sweeteners in health shops?	1	5	0
Do you buy your sweeteners in the supermarket?	6	0	0
Do you like the snacks you tried?	6	0	0
Do you like the beverages you had?	6	0	0
Did you feel an aftertaste?	6	0	0
Would you sweeten your foods and beverages with Stevia?	6	0	0

Table 4.4. shows that all participants answered that they are health conscious. Four of them worry about their weight and the other two said they do not. When asked where they buy their sweeteners all of them replied "*In the supermarket*", however, there was one participant who said she also buys them from the health shop. Four of the participants said that they do not feel an aftertaste in their current sweeteners. All of the participants wrote that there was no aftertaste in the food and beverages prepared with Stevia, which is contrary to the responses they gave during the focus group session, where some of the participants mentioned that they got to feel an aftertaste in the food prepared with Stevia. Some of them doubted if that aftertaste was actually derived from Stevia or from the amount of Stevia used, from the recipe or other ingredients. The participants in this group liked the food and drinks prepared with Stevia-based products according to the responses given in the questionnaire and during the session. All herb experts agreed that they would like to sweeten their food and beverages with Stevia.

All participants in this group suggested that they would replace their current sweeteners with Stevia. Some of them would like to try the leaves, most of them however, would use both forms (processed products and the plant) because conventional people such as

for example children, would not like the green colour, they believed. This group of participants is not the best example of what the real situation of Stevia is in New Zealand, because more than half of them knew about it before the session.

Almost all the participants in this focus group agreed about the sweetness of Stevia, they stressed that it had a strong sweetness. However, there was one participant who said “... *it is not that sweet*”. In comparison with the literature, there is no difference from what was said in this focus group about the sweetness.

All participants in this focus group liked the taste of Stevia and the different food and drinks prepared with Stevia. They also acknowledged that there was no difference from the flavour of the food and beverages they are used to. In the literature, it is usually cited that most participants feel a bitter and sometimes a sour taste, however this was not the case with any of the participants in this focus group.

As explained before (in section 4.2.2., paragraph 3) there is a lot that can be found on the aftertaste issue in the literature. There were two participants who said they did not feel an aftertaste. The rest of participants of this group did feel an aftertaste after trying the food and drinks prepared with Stevia. They were trying to identify what it could be and they mentioned the following things as possible causes: the amount of product that was used, the fillers used, the glycosides themselves (Stevioside, Rebaudioside), or even a different recipe from those to which they are accustomed.

To discuss the quantity issue in this focus group, please refer to the Discussion section of the General Public focus group (section 4.2.2., paragraph 4), because the situations in both groups are similar on this issue.

To discuss the texture issue in this focus group, please refer to the Discussion section of the General Public focus group (section 4.2.2., paragraph 5); as with the quantity, this issue also is similar to that in focus group one.

When the literature refers to the appearance issue there are two different approaches: first, for the plant and second for the Stevia-based products. The first approach states that Stevia home made extracts, or syrups, and Stevia leaves (fresh, dried, whole, grounded) will change the appearance of food and beverages (Kirkland, 2000). The leaves will also leave remanent since they do not dissolve. On the contrary, most of the processed products do not change the appearance of any food or beverage. Participants in this focus group were aware of these, and the majority replied that if it was for themselves they had no problems with the change of colour that the leaves and natural syrups leave, but that *“for more conventional people it could be an off put”* for example, for children, they said.

Some areas of interest amongst the participants of this focus group were: extraction methods, consumption by children, the reaction of Stevia with other flavours, fillers used, Stevia uses, cooking, properties, price, product characteristics, places of supply, growing issues, different applications, and forms. To see some additional discussion about the information issue refer to the Discussion section of the General Public focus group (section 4.2.2. paragraph 7).

The experts could be considered people that are more health conscious, people that look at the quality of the things, not the price, and people that know what it takes to grow things, therefore it is understandable that most of them replied that they look at the product more than at the price when buying a sweetener. This fact coincides with what was said in the Discussion section of the General Public focus group (section 4.2.2. paragraphs 8 and 10).

To discuss the place or availability issue of this focus group, please refer to the Discussion section of the General Public focus group (section 4.2.2. paragraph 9). Participants in this focus group are more aware of where to get plants or healthy products; therefore for them, the place was not a big issue.

The herb experts suggested that Stevia could be added to products such as drinks (cordial, fruit drinks, lemonade); bakery (biscuits, pastry); sweets (preserves, gummy

bears, chewing gums, bubble gums); dairy products (ice-cream) others (jam, drink sachets, toothpaste, skin products, vitamin C tablets). The list includes many sectors of the food industry as well as other kinds of products. The preference for natural products is a characteristic of this group of people, therefore the addition of Stevia to a range of products could have a potential market amongst them.

The participants in this focus group cited sugar as their sweetener, and one of the participants said that she uses honey. In this sense sugar would be Stevia's main competitor since the members of the Herb Society mentioned that they do not use artificial sweeteners because they know the side effects these cause. They believed that Stevia-based products could be of use to them for many recipes and that the leaves would be good for herbal tea.

Participants in this focus group are involved in the world of herbs, medicinal plants, and so on; therefore they know there are different views, opinions and laws that rule the consumption of each plant. Stevia is in a position where there is still not a universal consensus about its approval. Stevia is still not approved as a food additive in New Zealand (for more details refer to Chapter Two, section 2.7.5.), however, the plants are available and can be used for different applications. One of the participants believed that the situation of Stevia can be compared with organic produce, where it is hard to change the mind and traditions of people who do not see or do not want to see the effects (of harmful treatments or of artificial sweeteners and sugar).

When it came to the health and research issues, participants showed interest in finding out about the recommended intake of Stevia, consumption of Stevia by children, and the benefits it could give to those with diabetes but also to the general public. They suggested that if Stevia decreases the intake of sugar and artificial sweeteners in New Zealand, this could have benefits for the whole society.

Special interest was shown in the growing issues. Participants in this focus group were all interested in knowing more about propagation matters, caring for the plant and other things needed for growing Stevia. The researcher did not go into this in great detail

since it is not the area of study, but basic things were explained (see Chapter 2 – section 2.5.)

The herb experts were interested in using both main forms of Stevia: the plant itself and the processed forms. They suggested the plant would be good for cooking, and as a lotion. From the processed forms they admitted that they would use the powder more. Children and people who are not very familiar with herbs may not like the appearance of the food and drinks prepared with the leaves, therefore they said they would need to use the processed form. This comment is something that has to be considered since it is an important marketing issue when it comes to identifying the different market segments.

4.4. Results of the Diabetics Focus Group

To recruit participants the researcher first went to their facility and explained what the research was about. Some time before the focus group session, in one of the members' meetings, the researcher presented some Stevia work to some of the members. A "sign in" paper was left for interested people to use to send in so that the researcher might contact them.

This focus group comprised eight diabetics whose demographic information is presented next. They all were New Zealand residents living in the Manawatu area.

The third focus group was organised with members of the Manawatu Diabetes Society. This group included seven female participants and one male participant. All participants in this group were 50 years old, or older; and all were Caucasian.

Most of the diabetics (6) responded that they like sweet things "moderately"; and two of them said they are indifferent to sweet things. More than half (6) of the participants use sugar substitutes "sometimes", one uses them "often" and the last one "never". When asked if they use sweeteners in their beverages, five of the diabetics answered "sometimes", and the other three do not use them. For their cooking and baking, 50% of the participants use sugar substitutes, two of them use sugar, one of them uses sugar and sugar substitutes and the last one did not answer this question. To the question asking if they go to health shops, five diabetics go "sometimes" and three participants responded that they "never" go to health shops.

Three participants answered that they did not know about the existence of Stevia before the focus group session. One of the participants who did know about Stevia recalled that she had a *"friend who had a coronary implantation and he was using natural medication, and Stevia was part of his diet, which was only vitamins, minerals and Stevia"*. Two others replied they had known about Stevia before, but they did not recall from where. Another one who was familiar with Stevia said that she heard about it from her sister who worked at Massey University, and who heard about the project from the

researcher. The last member of the focus group said he first found out about Stevia at the meeting where the researcher gave a presentation about Stevia's potential.

When the participants were asked if Stevia drew their attention, all replied "YES" they were interested. When they were asked to give the reasons why they were interested, they mentioned the following things:

- *"it is sweet and natural";*
- *"one can watch it grow and look after it,... in our environment you know, so you know you are not putting sprays and things like that...";*
- *" because it is a herb".*

To the question "Would you replace your current sweetener with Stevia if it was available?" all participants said that they would. Given the choice and the availability Stevia offered the diabetics a viable alternative to their current sweeteners. Most of the participants were interested in trying both types: the leaves and the processed products. One of the participants said she would rather grow it first.

The results of this focus group are discussed in the section described below. The consumers' acceptance of Stevia is analysed according to the scheme presented in Figure 4.1.

4.4.1. Potential uses of Stevia

As with the two previous groups the framework described in Figure 4.1. has been used as the template for analysis.

1. Sensory Evaluation

The issues discussed below are extracted from what participants expressed in the focus group session.

1.1. Sweetness

Participants of this focus group had different opinions on the sweetness of Stevia, however most of them did feel the sweet taste of the leaves and products. The different

positive opinions about Stevia's sweetness ranged from "...*exceptional sweet tasting*" to "*tasted just adequately sweet*". One participant in this group revealed that diabetics do not have very sweet things in their diets, therefore they are more sensitive to sweet tastes, and because Stevia is very sweet diabetics may be very sensitive to its sweetness. Hence the two negative answers about Stevia referred to the "*strong or excess sweetness*", which is understandable given the explanation provided by this participant.

1.2. Flavour

Participants in this focus group referred to the taste mainly by saying they liked the food and drinks very much, especially the orange juice. One of the participants stressed that he "*appreciated that the flavour [of the foods] was not altered or bitter from usual*". Another participant made a positive comment about the good taste of the leaves. There were no negative opinions on the flavour.

1.3. Aftertaste

One member of the focus group reported a slight, sweet aftertaste, however none of the rest of the members reported tasting anything.

1.4. Quantity

Participants of this focus group were interested in knowing how to calculate the quantity of Stevia necessary to provide the desired level of sweetness. One participant was particularly concerned about "*How much is too much*" worrying about the recommended intake and if it was possible to take too much.

1.5. Texture

One participant reported that she thought the buttercookies were dry, however, none of the group made any comments which reflected the effect of Stevia on the texture of the product.

1.6. Appearance

Most members of this group made no comments on the appearance of the Stevia sweetened foods, however one participant made a comment that the product had a

colour which was slightly different from that which he had expected, but that the discolouration did not affect his opinion of it.

2. Market Issues

In the same manner as with other focus groups the members of this group described issues which related to information, marketing and new products. These issues are described below.

2.1. Information

Focus group members sought general information about Stevia and its uses, in particular issues to do with recommended quantities, health, products, marketing and growing the plant. Overall, members of this group had far more detailed requests than had the members of the general public focus group.

2.2. Marketing Issues

In this section issues to do with the price, product and place that Stevia products are marketed are discussed.

2.2.1. Price

When the participants were asked about the things they consider important when buying their sweetener most of them replied that the price is something they consider is important. However, there were participants who added that it also depends on other things. One participant responded that he looks not only at the price but at “everything”, this could be considered to mean that he looks at the price, the product characteristics and its availability. To have an idea of what to expect and as a basis for comparison with the prices of their current sweeteners other participants were interested in knowing how much the plants were sold for and what the approximate cost of Stevia was.

2.2.2. Product

Besides the price, the diabetics mentioned other things they consider important when they choose to buy a sweetener. A range of factors from the taste, the content, the form, affected participants' feelings about the nature of the product they prefer. One of the

participants considered the fact that when Stevia is in a form that is 200 times sweeter than sugar it would be attractive because much smaller quantities would be required.

Specific questions asked by the participants related to issues about the quantities to use, how to utilise the various products, what fillers the manufacturers use for the processed products and how to best dry the leaves.

2.2.3. Place

The participants who already knew about Stevia complained that Stevia is not available everywhere in New Zealand. One of the participants said that he “*would like to find some of these [Stevia] products on the shelves in the supermarket*”. Participants felt that there was simply not enough access to Stevia for their everyday sweetener requirements: although some members knew where to get the products others felt that it should be as freely available as the other sweeteners they use. They were curious about knowing where they could purchase the plant.

2.3. New Products

The researcher identified some of the new products from the context of the focus group, but also from the specific answers of the participants when they were asked to give ideas of new products that could contain Stevia. Table 4.5 presents the New Products listed by the diabetics.

Table 4.5. New products listed by the participants of the Diabetics focus group:

New Products	Definition	Suggestions
2.3.1. <u>Drinks</u>	Something you take into the mouth and swallow (a liquid). Drinks are all the beverages that participants suggested could be good products containing Stevia	Soft drinks, general drinks
2.3.2. <u>Bakery</u>	Products such as bread, cake, and pastries are baked or sold	Baked products
2.3.3. <u>Sweets</u>	Foods, such as candy, pastries, puddings, or preserves	No suggestions were given for this category
2.3.4. <u>Dairy Products</u>	Products made out of milk or its derivatives	Dairy products
2.3.5. <u>Others</u>	Different from that or those implied or specified before	Muesli bars, jam

When comparing this table with the previous focus groups' "New Products" tables, the only different idea that was listed here was muesli bars. All other products were the same, and there was not as much specification by the diabetics as in the previous focus groups.

2.4. Competition

As diabetics are a special group of people whose conventional sugar intake is very limited, the competitors for Stevia are either the sweeteners prescribed for them or the artificial sweeteners. However, one member of this focus group said that she uses some sugar in some of her cooking, however, she has to do this in a very careful way.

All participants used Splenda as their sweetener. Splenda is a sweetener commonly prescribed for diabetics which can be used for cooking but which leaves an aftertaste. There were no other sweeteners mentioned by this group.

3. Health and Research Issues

Health and research issues related to the use of Stevia were at the forefront of the interests of this group of participants because of publicity about it in the recent past. This publicity arose as an unknown member of "Diabetes New Zealand" had put negative information on the website. This information was from an old publication about the effects Stevia could have on the reproductive system of men. Although this work has been refuted (Bonvie et al., 1997b) the concerns raised meant that focus group members were primed to express concerns about the effects of Stevia use on their health.

3.1. Safety issues

Considering the situation described above, many participants were concerned about the safety issue. One of the participants who was confused about Stevia's market release, asked: *"So if there are concerns by health professionals how is it allowed to be sold? You know it seems to be of little concern"* Others however, were in no doubt about Stevia's properties and benefits. The concerns raised in the web page have led to a considerable amount of ill-founded criticism of Stevia and Stevia products amongst

some members. These and similar concerns continue to be a source of difficulty in establishing Stevia as a safe alternative to artificial sweeteners for diabetics.

3.2. Health issues

One participant said that Stevia is good for cooking and that it does not produce the side effects artificial sweeteners do produce. She said, "*It was good to use Stevia because she was able to use it in cooking without any side effects*". This participant could see further benefits if Stevia could be shown to lower blood pressure. The researcher related claims that Stevia did, in fact, reduce blood pressure and therefore could help in such a manner. Another participant also wondered if Stevia might not be good for her as it would help her out cut down her sugar intake.

3.2.1. Diabetes issues

Most participants agreed that Stevia appeared to be a wonderful alternative sweetener for diabetics, however, one of the participants said that diabetics become accustomed to unsweetened foods, therefore products do not need sweetening at all. This view was not that of the majority of participants in the focus group, who felt that they do like sweet food.

3.2.2. Obesity issues

This issue was not part of the discussion of this focus group.

3.3. Research issues

Because of the comments at the beginning of the session, participants agreed that there should be more research on Stevia and if researchers want to catch the attention of the public they "should have more research done even in New Zealand". There was one participant who could not understand how and why Stevia could not be legally accepted as a sweetener in the New Zealand food industry.

In terms of the production of Stevia, members of this group wanted to know more about its production and processing commercially and its properties in cooking.

4. Convenience

The participants of this focus group asked many questions that concerned this issue. A lot of interest was shown in the growing and uses of Stevia.

4.1. Growing

Many questions about growing Stevia were asked. Participants were interested in issues like growing it inside, outside, care needed, species, and so on. Participants wanted to find out about propagation matters, and a range of crop husbandry factors such as growing conditions, fertilisers, season, and whether the crop prefers to be grown in open ground or containers. One of the participants was interested in the varieties and species of Stevia; he asked about the availability of species and wanted to know if the plants available in New Zealand were the same as the ones in Paraguay. Members of this focus group were interested in growing the crop and would use the leaves produced in such a way as a sweetener.

4.2. Application

As in the previous groups the participants in this group also wanted to find out more about the different applications in which Stevia is available.

4.2.1. Plant

Using raw Stevia leaves in cooking or baking was the only application that interested the diabetics' focus group. One of the questions asked about it was: "*Can I use the whole leaf to sweeten food or not?*", the second one was more specific: "*Could you cook with, like, taking a couple of leaves on and put it in a rhubarb- would it work like that to sweeten something?*" and the third one was a more general one: "*I am not sure how to utilise it? Do you know?*". These statements support the idea that diabetics felt that growing their own sweetener was appealing.

4.2.2. Processed products

There were several ideas mentioned by group members about the use of processed Stevia products in food. These ideas related to the easy use of a substitute sweetener in various food and beverage products. The main ones were:

“easy of use in coffee”

“I would like cooking lessons and how to adapt my recipes for use with Stevia”

“Making jam with it could be possible, fruit or yellow cream, and using amounts of Stevia and you could seal the bottles with a little wax ...”

4.3. Form

One of the participants was concerned that although there may be different products for different situations she would find it confusing to know which to use. If there were a great many different Stevia products in the market she felt that she could be so confused as to give up. Participants in this group discussed the advantages of using a powder form because it would be easier to measure, but they also mentioned the fact that the liquid extract and the use of leaves in their natural form could be desirable because these were more natural forms. The concerns about the fillers used in processed products are important to consider when the form of Stevia products is discussed.

4.3.1. Powder

Seven out of the eight participants selected the powder as their preferred form of Stevia sweetener. The reasons include that it can be used for cooking and beverages; that it is a dry ingredient that is easy to mix with other dry ingredients such as flour, that it is easy to use because it is easy to measure and that as dry ingredients are used in traditional cooking and sweet making such a product could relatively easily be adopted for use.

4.3.2. Liquid extract

When the participants were asked if they would be interested in the liquid extracts, three of them agreed that some cooking lessons or demonstrations would be helpful and maybe then they would like to try them.

4.3.3. Plant

Following the long discussions about growing the plant there were relatively few discussions about using the plant in its raw form as a sweetener. The issues have been raised elsewhere, however, two additional factors were discussed. The first related to the ease with which leaves could be dried. The second related to the length of the time that dried leaves could be stored. However, participants felt then if they could grow the plant that using it in this form would be desirable.

4.3.4. Others

The participants themselves did not mention other forms in which they would be interested. The researcher asked them if they would like to be able to purchase pre-sweetened teabags and they provided responses which indicated some support. However, respondents also felt that they would need more information before they could be committed to such an idea.

4.4.2. *Discussion*

To give the reader a better understanding of the context in which the participants are living their responses are presented in Table 4.6. below.

Table 4.6. General context of the diabetics' attitude towards sweeteners

Questions	Yes	No	Did not answer
Are you a health conscious person?	8	0	0
Do you worry about your weight?	5	3	0
Does your current sweetener have an aftertaste?	5	3	0
Do you buy your sweeteners in health shops?	0	6	2
Do you buy your sweeteners in the supermarket?	8	0	0
Do you like the snacks you tried?	8	0	0
Do you like the beverages you had?	8	0	0
Did you feel an aftertaste?	2	5	1
Would you sweeten your foods and beverages with Stevia?	8	0	0

Table 4.6. shows that all diabetics answered that they are health conscious people. Five of them worry about their weight. When asked where they buy their sweeteners all of

them replied that they buy them in the supermarket. Five of the participants remarked that their current sweeteners leave an aftertaste and three said that they do not. Comparing these answers with those given during the session, there is a difference since participants did report that their current sweetener “Splenda” leaves an aftertaste. It would appear as if participants felt a peer pressure during the session and therefore, those who marked this question with a “NO” were not able to give their opinion freely before.

Most of the participants (5) said that there was no aftertaste in the food and beverages prepared with Stevia, whereas two of them said that they did feel an aftertaste. During the focus group session there was one participant who reported having felt “*a slight, sweet aftertaste*”, but the second participant who marked “YES” in the questionnaire did not speak out during the session. In the last points of the questionnaire, all participants marked that they liked the food and drinks prepared with Stevia-based products. All participants in the diabetics group agreed that they would like to sweeten their food and beverages with Stevia.

In this group, most participants had not known about Stevia before they met the researcher. When they first found out about it they were mainly attracted to the fact that it is a herb, it is sweet, natural, it does not affect the blood sugar levels, and it is recommended for diabetics. When they were asked if they would replace their current sweetener with Stevia if it was available, all of them replied that they are interested in replacing their current sweetener with Stevia. Most of the participants said they would like to try both types: the leaves and the processed products. These results coincide with what the researcher assumed at the beginning of the research: that the diabetics’ group would be one of the most interested groups in the introduction of Stevia in New Zealand as an alternative sweetener.

One of the main characteristics of Stevia and Stevia-based products is its sweetness. Most people who had tried Stevia relate to its “strong” sweetness but others think it is just normal or quite sweet. Amongst the diabetics there were three different opinions, those who thought it was excessively sweet, those who said it was sweet and finally

those who stated “it tasted just adequately sweet”. In this sense, this group could be considered a representation of the population the literature describes.

As was stated before, the flavour issue is a subjective area where a lot of variables have to be considered. The participants in this session referred to the taste of the products as being “very nice”, “very good”, and one of them highlighted the fact that the taste was neither altered nor bitter. He found this last characteristic good in comparison with what they are normally allowed to use (artificial sweeteners, which are known to have an aftertaste).

Considering that this group is a special group because it involves people with diabetes who are not allowed to eat and drink everything they want, especially when it comes to sweeteners, it is worth looking at their reactions when asked about the aftertaste. One respondent admitted there was an aftertaste - but said that the taste left behind was a pleasant one. All others responded that there was no aftertaste from the Stevia. Diabetics are allowed to use certain sweeteners and according to what was said, these are artificial sweeteners. Participants stated that the sweeteners they use have an unpleasant aftertaste. However, the usual comparison is with sugar, and people accustomed to using sugar note a difference usually saying that Stevia leaves an aftertaste. Conversely, these people are accustomed to artificial sweeteners and they affirm that Stevia does not leave an aftertaste like the artificial sweeteners do.

The quantity issue is the same as in the Discussion section of the General Public focus group (section 4.2.2.).

The texture issue of this focus group is the same as in the Discussion section of the General Public focus group (section 4.2.2.).

See the discussion on section 4.3.2., of the Herb experts’ focus group. Appearance was not an important issue for the diabetics. They did not take time to discuss it and when asked about their opinion they replied “it does not matter”.

Diabetics are considered to be one of the most likely markets for Stevia. Recent research (Ibarrola, 1996; Jeppessen et al., 2002) shows that Stevia could be used in the treatment for diabetes Type II. The researcher did not know many of these issues when the focus group session was conducted, so this specific issue was not mentioned to the participants and they did not know about it either. The researcher mentioned that it seems to be all right for diabetics but with no further details. It also was specified that it is important that the affected people understand well when they are permitted to use it and when not. Diabetics of this focus group, therefore, did not ask many questions about its use for the disease itself, but the participants asked questions about how to use it, how to grow it, how to dry the leaves, how much to use and so on.

It is difficult to define what diabetics consider more important when buying a sweetener, since they first answered “the price” but later they also said that different characteristics of the product were important. To complete the information on price and product issues see section 4.2.2. of the General Public focus group.

Since Stevia is not well known yet in New Zealand, it is not found everywhere; and in this respect, the researcher compares the situation to what usually happens in the market when a new product is to be launched. Sellers first want to find out if there is a market for it, but the market cannot ask for it if they do not know it. It is like a wheel, and participants in this focus group complained about the fact that Stevia is not freely available in New Zealand, so once more it is shown that place is a very important issue for consumers.

The diabetics did not give many ideas when asked to suggest ready-made products that should contain Stevia.; they listed drinks (soft drinks), bakery (baked products), dairy products, others (jam, muesli bars). The researcher, however, noticed that the participants were interested that Stevia was used in food and drinks that are especially prepared for diabetics. The fact that many ready-made products are available in other countries (especially in Japan) was a positive point, the participants said.

As was mentioned before, diabetics are not allowed to have whatever sweetener they like. There are just a few sweeteners (artificial sweeteners) which they can consume. Most of the participants in the focus group did have negative comments about their current sweetener. They mentioned some disadvantages like aftertaste, bitter taste, altered flavour of food, not being able to cook with it, and so on. Nowadays, the promoters of Stevia are focusing more on the replacement of artificial sweeteners rather than of sugar, considering the negative promotion artificial sweeteners have been receiving over the past few years.

Participants in this session did not say a lot about the safety and health issues. They were doubtful about the reasons authorities give for not allowing Stevia into certain countries. The fact that it is consumed in many countries and that it has been consumed for many hundreds of years should be sufficient proof of its safety, they said. When the diabetes issue came out, one of the participants stated that Stevia could be a good replacement for the artificial sweeteners since it had no side effects, it is natural and as diabetics do not use too much sweetening, Stevia could solve their problem. The negative side of artificial sweeteners is giving Stevia an optimal chance for a successful introduction into many countries (including New Zealand).

As there are still some countries that do not approve the free consumption or sale of Stevia (as has been mentioned previously), there are some concerns amongst people who are not very familiar with the herb. This was an issue for some participants of this focus group. They considered that there should be more research done on Stevia's safety, not only in other places but also in New Zealand. One of the participants, who had known about Stevia's benefits previously, stated that she could not understand why it was not accepted as a sweetener.

There were different areas of interest on the growing issue. Participants wanted to know about the possibility of growing the plant outside or inside, they also asked about some of its care requirements and propagation forms. One of the participants was also interested in finding out about the different species and varieties. These were not the focus of the research, therefore only basic information was given to the participants.

Once again there is similarity between what is said in the literature and the results of this focus group. The participants did ask or comment about the different applications that the leaves and/or the Stevia-based products could have. The diabetics showed special interest in the possibilities of cooking with the leaves. They also noted that using the processed products would be easy and that they would like to use them as a replacement for their current sweeteners.

There was agreement amongst the diabetics on the preferred form. Most of them stated that the powder would be their preferred form. The reasons for this would be that it is easier to measure and to use and that it is a dry ingredient as sugar and most of the artificial sweeteners are (which is a tradition in sweeteners). Their opinion about the liquid extract was that they first would need some cooking lessons, because they are not accustomed to using liquid extracts. They also said they would like the plant but that it would be more difficult to cook with it. Tea bags containing Stevia could be a potential sweet drink, but it would not be useful for anything else. When it comes to defining what the preferred form is for groups of people, it is difficult to establish an impression about the form issue, because this changes from country to country, or from culture to culture (J.C. Fischer, 26 December, 2002, personal communication).

4.5. Results from the Maori Focus Group

The fourth focus group was organised with Maori. There were three female participants and four male participants who were part of this focus group. Most of the participants (3) were between 19 to 25 years old. Two of them were between 26 and 35 years old and the last two were 50 years old or more. This group was entirely Maori.

Most of the Maori (5) responded that they like sweet things “moderately”; one of them likes them “very strongly” and the last one likes them “strongly”. More than half (5) of the participants “never” use sugar substitutes, and two of them do use them “sometimes”. When asked if they use sweeteners in their beverages, five of the Maori answered “sometimes”, one uses them “always”, another one “often” and the last Maori “never” sweetens beverages. For their cooking and baking, half of the participants use sugar, one of them uses sugar and sugar substitutes and the last two did not answer this question (males do not often cook or bake). The majority of Maori of this focus group (5) never go to health shops and only two of them go “sometimes”.

This group was identified in the literature as being another potential market for Stevia as the Maori population suffers from increasing rates of diabetes and obesity (Press Release: MOH, 1999). For the recruiting of participants the researcher contacted a person who was organising a hangi. This person suggested approaching the guests at the hangi about joining the focus group before the celebration started.

The first seven guests who arrived were invited to take part in the focus group session. After the session ended, the researcher concluded that this focus group had not proceeded as planned. The participants were not interested in assisting the researcher and did not focus on the research question; rather they wanted to get on with their celebration as soon as possible. This being said, some of the issues raised at this focus group are pertinent to this research and are thus presented in this section.

None of the participants had heard about Stevia before being approached to participate in the focus group. Furthermore, they were all interested in Stevia once they had heard a

little about its potential. At this early stage, they were not sure if they would replace their current sweeteners with Stevia because this was their first experience with it. After tasting some of the products, members of the Maori focus group were still unsure about Stevia and one participant went as far as saying he would probably not be interested.

The results from this focus group are discussed in the section below and they are analysed according to the scheme presented in Figure 4.1. at the beginning of this chapter.

4.5.1. Potential uses of Stevia

This focus group session was very brief. Participants were unwilling to commit time to the research, and for this reason, although the main categories were covered, little detail was collected from the participants.

1. Sensory Evaluation

Participants of this focus group tasted food prepared for them in the same manner as for other focus groups.

1.1. Sweetness

Most of the participants of this group said that they did not feel the food was very sweet. Members of this focus group appeared to prefer food that was sweeter than had been presented to other focus groups. For this reason, opinions such as: *“these are not very sweet”* and there *“is not a lot of sweetness in it”* were expressed. A third person recognised that the sweetness depended on the recipe and suggested that if a second tasting were to be conducted greater quantities of sweetener might be used.

1.2. Flavour

Participants reported that the sweetness in the food and drink prepared tasted different from the sweetness they felt they gained with sugar; however, one participant said that *“the flavour was OK”* while another reported that they liked the sweetness but had mixed feelings about the different taste.

1.3. Aftertaste

Most participants did not report tasting any aftertaste, however one thought that there could have been an aftertaste in the orange juice, reporting "*Possibly in the orange juice, but that might have been the orange juice itself so, don't take that into consideration*".

There was no discussion about issues to do with the Quantity, Texture and Appearance of the products tasted in comparison to what they are used to.

2. Market Issues

Participants had some general interests in Market Issues related to Stevia.

2.1. Information

Participants in this focus group asked questions about the commercial production of Stevia, the countries that undertake it, and the commercial sales of the product. Members of this focus group were interested in commercialisation of the product rather than the use. One of the participants was concerned about the fillers manufacturers use for processed products. He mentioned that many people (including himself) have lactose problems, and that other fillers such as dextrose and maltose are still sugars and that many people do not know that, by consuming them, they are still consuming something with sugar.

2.2. Marketing Issues

Price, product and place were Marketing Issues of interest to the Maori focus group.

2.2.1. Price

The price is an important issue for the members of this focus group. All participants were interested in finding out the prices of the different products available during the session. One of the participants confessed that he could not afford such prices. Another respondent considered that the prices of the products were "*a little expensive*". Members of this group were sensitive to the prices they pay for their sweetener. One member was interested in the costs of production of the Stevia crop.

2.2.2. Product

There was little discussion about the choice of product. One of the members felt that the tradition of using one sweetener would be hard to break. *“I suppose it would come down where you might need a lot of time changing people’s opinion. If somebody consumes sugar for 30 to 40 years they probably will be quite resistant to change”*.

2.2.3. Place

Although one respondent thought that Stevia might be available in health shops, participants felt that Stevia is difficult to buy in New Zealand because it is not available in supermarkets or groceries.

2.3. **New Products**

The Maori group did not go into details when it came to suggesting some products that could contain Stevia as a sweetener. Apart from the use of Stevia in sweets such as toffee and fudge, they identified that they might use it in products such as jam or skin care products.

2.4. **Competition**

Participants in this focus group felt that the main competitor for Stevia for them would be sugar. The participants reported that there are some properties of sugar that Stevia does not have, for example, sugar caramelises making the manufacture of toffee or fudge possible.

Other considerations of the participants were 1) that it is difficult to change a habit, and buying and consuming sugar is a habit; 2) that buying Stevia to sweeten some of the food and drinks would be a *“little redundant”* because they could not give up sugar entirely; and 3) that the presentation of the packaging of sugar does not matter, *“sugar is just sugar”*.

There was no one who mentioned or commented on artificial sweeteners in this group. There were no other sweeteners mentioned in this group.

3. Health and Research Issues

There was not a deep discussion about these issues amongst the participants in this focus group. The main points addressed were about: 1) the properties Stevia has for teeth care, 2) some opinions about diabetes and Stevia, 3) some research issues and 4) weight management issues.

3.1. Safety issues

There was nothing mentioned on this issue in this focus group.

3.2. Health issues

There was one participant who mentioned he was interested in Stevia because of the properties it contains which are beneficial on teeth, he said: *"I like that it's not so hard on your teeth. I worry about teeth."* No other considerations were given to the health issues.

3.2.1. Diabetes issues

The participants brought this issue to light asking what the research says on the consumption of Stevia by diabetics. There was one participant who made some comments about the fillers used in the products, saying that some of them were not recommended for diabetics. (refer to Appendix 6, Table A.4., point 3.2.1.). The researcher explained that there is recent research that shows that Stevia could be used for the treatment of type II diabetes and that the manufacturers know what fillers can be used and which ones cannot. In Brazil, Paraguay and Argentina for example there are specific Stevia products for diabetics (J.C. Fischer, personal communication, 26 December, 2002).

3.2.2. Obesity issues

This issue was one of the main attractions for the participants in this group, according to what they said. Participants were told that Stevia has no calories and that it is taken to lose weight. One of them stated about Stevia that *"the major advantages I can see were related to the weight loss"*, and another one agreed with that.

3.3. Research issues

There were observations of the participants that *“a bit of research would have to be done”* and that *“the product needs some more research”* to convince the people to use Stevia as a substitute for their current sweeteners.

4. Convenience

There was interest shown in the convenience category, especially in the growing of the plants and the different forms of presentation of the Stevia-based products.

4.1. Growing

Five out of the seven participants answered that they would like to grow their own Stevia plant. Maori do like to grow plants and use them with medicinal purposes as an old tradition (Ngā Tipu Whakaoranga infobase, 2002). This fact may explain the interest in growing issues and may be the first step for Stevia's introduction amongst Maori.

4.2. Application

This category was scarcely mentioned amongst the participants of this focus group.

4.2.1. Plant

Neither questions nor comments were made on this specific issue.

4.2.2. Processed products

One of the participants said that she would use the processed products for baking purposes. There were no other comments about the uses processed products could have.

4.3. Form

When asked about their preference in using Stevia-based products or the Stevia plant itself, there were two different answers. The first group of people (4 out of 6 participants) said that they would prefer to use the processed products. The second

group (2 out of 6 participants) responded that they would first like to grow their plant and then buy the Stevia-based products.

Following the previous question participants were asked about their preference in form of the products, see below to know their answers:

4.3.1. Powder

Participants in this group agreed that they would prefer to use the powder form. When asked to give some reasons for that choice they cited the following: it is similar to sugar (a dry ingredient), and that it is easier to measure (for cooking and baking)– not like the liquid extract, they said.

4.3.2. Liquid extract

One participant asked if the liquid extract “*would have a certain amount of flavour from the leaf on it?*” the researcher did not ask for a specification if he liked or did not like that flavour and responded that it depends on the quality and/or brand of the product. When the researcher asked the participants about some advantages they could cite about the liquid extract, they replied that it “*dissolves easily in a drink*”.

4.3.3. Plant

As was mentioned before almost all participants said they are interested in growing the plant; however they did not mention anything about how to use it for their cooking.

4.3.4. Others

Participants in this focus group gave their opinions on two other forms of Stevia-based products: the tablets and the little sachets. The majority thought that the tablets are easy to use, because one just drops them into the drink; however there are not many uses for the tablets, for example one could not cook with them; the only use the participants cited was for drinks. One participant indicated that the sachets are practical to use but because of the quantity, the problem would be that you would run out of them very quickly and that you would spend a lot of time in the supermarket or health shops buying them.

4.5.2. Discussion

Table 4.7. presents some general information about the Maori attitude towards: a) their current sweeteners, b) foods and beverages prepared with Stevia and c) some auto-analysis of themselves.

Table 4.7. General context of the Maori attitude towards sweeteners

Questions	Yes	No	Did not answer
Are you a health conscious person?	4	2	1
Do you worry about your weight?	2	5	0
Does your current sweetener have an aftertaste?	1	6	0
Do you buy your sweeteners in health shops?	0	7	0
Do you buy your sweeteners in the supermarket?	7	0	0
Do you like the snacks you tried?	6	1	0
Do you like the beverages you had?	5	0	2
Did you feel an aftertaste?	0	6	1
Would you sweeten your foods and beverages with Stevia?	4	1	2

Table 4.7. shows that the Maori participants are the least health-conscious people amongst the four groups. Four Maori answered that they think they are health conscious, two of them said they are not and one participant did not want to answer this question. When they were asked if they worry about their weight, only two of them answered “yes”; the remaining five responded that they do not worry. When asked where they buy their sweeteners all of them replied “*In the supermarket*”. The majority of participants (6) responded that their current sweeteners do not leave an aftertaste and one remarked that they do, this situation being strange because all participants of this group reported that they use sugar as their sweetener.

Most of the participants (6) responded that there was no aftertaste in the food and beverages prepared with Stevia, and the remaining one did not want to answer the question; in this situation the responses to the questionnaire coincide with the answers given by participants during the focus group session. Many participants said that they liked the food and beverages prepared with Stevia-based products (6 and 5 respectively). However, when it came to answering if they would sweeten their food and beverages

with Stevia, four of them answered “yes”, one said “no” and the other two did not answer the question.

The Maori group is the only one in which none of the participants had known about Stevia before. When the participants in this group were asked if they would replace their current sweetener with Stevia, there were no firm answers. The participants were not sure about their answers to this question and maintained that because this was their first experience with Stevia and because they had tasted some of the food and drinks, they would need more time and experimentation with it before responding to that question. They would also need to get some more information about Stevia. The Maori group was expected to be the other group that would be most interested in the introduction of Stevia into New Zealand. In other words, several benefits for the Maori could arise if they were to replace their current sweeteners with Stevia (according to the diabetes forecasts for the future (Ministry of Health, 2002)). However, this was not the case, since they did not respond with a positive attitude towards it. But, they did not totally reject the idea: they just need to have more information on it and experiment with it first, they said.

The Maori group differs from what the majority of people think about the sweetness of Stevia. Most participants in this group concluded that it was hard to give an opinion on the sweetness because they could hardly taste it. This fact is the opposite of what the literature and the majority of people think about the sweetness. “The Maori people of New Zealand eat a completely modern diet: 2500 calories with 125 grams of fat and 71 of sugar” (Hesse, 2002), which means they do eat a lot more sugar than is recommended⁵. The researcher could perceive and see that many of the Maori liked sweet things. These facts could explain the results from this focus group, because the researcher prepared all food and drinks in the same way for all four focus groups conducted and the only ones who thought it was not sweet enough were the Maori. Once again tradition and habit play an important role when it comes to evaluating something - in this case, the sweetness.

⁵ “People should get no more than 10 percent of their calories from sugar, experts say in a major new report today on how to stem the global epidemic of obesity-linked diseases” (*Associated Press*, 2003)

There were not many comments on the flavour issue amongst the Maori. The few opinions gathered were that the taste was all right and that there was a difference from the taste of sugar (this situation, however, could be the effect of many causes, such as the recipe, the amount used, the processed products used, and so on). As this is a subjective area and customs and habits play an important role when it comes to the flavour, it could be said that Maori have a different palate when it comes to describing taste and sweetness.

There were no negative responses about the aftertaste in the food and beverages prepared with Stevia. This might be because the products did not leave any aftertaste or because of Maori eating habits.

The three last issues of the Sensory Evaluation - quantity, texture and appearance, were not discussed in this focus group. The researcher considers this to be an effect of the fact that they had not known about Stevia before and that there was a time constraint.

The questions participants in this focus group asked during the meeting were the ones most people asked (according to the Frequently Asked Questions in Kirkland, (2000) and Richard, (1999)) when they first hear about Stevia, for example: where is it grown?, where is it produced?, and so on. Other not so common questions asked in this session were: how is Stevia doing in sales matters? what fillers do manufacturers use? One of the participants exposed his concerns about the fillers that are being used. In this respect, most of the manufacturers of Stevia-based products have a wide range of different products containing different fillers. This fact shows that they are aware of those kinds of problems. In Paraguay and Brazil for example they are selling "lactose free" Stevia, or Stevia products for diabetics, and so on.

The price issue has an important value for the participants of this focus group. They responded that when buying a sweetener the price is one of the most important decision tools they consider. Since no one in this group had known about Stevia before, the researcher believes that they were not really aware of what Stevia is and the benefits it could bring to Maori society; this could explain why there were more responses about

the price and not so much about the product characteristics. To complete the information on price and product issues see section 4.2.2. paragraph 8, of the General Public focus group.

As is found in the literature, the participants of this focus group as well as in general, said that for a person to be interested in buying a product it has to be available in the place the person wants to buy it. Considering the characteristics of the product, the participants suggested that it should be accessible in the supermarkets and health shops.

There were few suggestions from Maori when it came to listing some new products containing Stevia as a sweetener. They recommended it for sweets and other products such as jams. Besides these, they mentioned skin products. The researcher, however, identified some other ideas from the context such as: top table sweeteners, drinks and bakery. The fact that this group had not heard anything about Stevia previously, makes it difficult for participants to introduce the idea of a natural, noncaloric sweetener into their minds.

For the Maori participants, sugar is the main source of sweetening according to their answers. All participants affirmed that sugar was their main source of sweetening. So, as identified in the results section for this focus group the main competitor of Stevia in this case is sugar. It is not worthwhile comparing sugar and Stevia, since their only similarity is that they are sweet. One of the participants said that it would be very difficult to change the habit of consuming sugar, and that there are not many factors which people consider when buying sugar, it is already in the people's mind, there is not much thinking to do when buying sugar. The researcher recognises that it will be difficult to change traditions and habits, but the change can be made slowly and Maori people first have to be aware of the benefits Stevia could give them (health-wise especially).

This group did not discuss many points about the health and research issues. One of the interests was about the benefits of Stevia for teeth; one of the participants stressed this point and exposed his interest in this special property. The other interest was in the

reaction of Stevia on diabetes, but there was some confusion there because there was no scientific evidence to dispel some doubts one of the participants had about it. As is common amongst people when they first find out about Stevia, the participants in this focus group pointed out that they would like to see more research done on Stevia.

The obesity reduction potential was something that the majority of participants agreed to be a benefit for them. If this interest is a reality and Maori people consume Stevia for weight management, many health problems amongst the Maori could be avoided and/or solved (diabetes, obesity, etc.). The literature refers to this issue as being one of the main concerns for New Zealand society (especially amongst the Maori); in this sense it appears to be one of the potential areas for Stevia's introduction into New Zealand.

Maori like to grow their own plants and crops as their ancestors did many years ago (Ngā Tipu Whakaoranga infobase, 2002). This characteristic is similar to that of the Guarani Indians of Paraguay, who are well known for their knowledge in natural medicine. Stevia's natural environment is Paraguay, however, Maori could include this herb in their list of natural medicinal herbs and use it as best suits them. Besides its property of being a natural sweetener, Stevia could help to improve the diet and nutrition habits of Maori, which could mean an improvement in their overall health.

The participants in this meeting admitted that they would like to grow Stevia. There was not much explanation of why, how and for what, but they answered that they certainly would want to have their own Stevia plant. None of the participants asked about the propagating or caring for Stevia plants, contrary to what the literature says to be common and to what the previous focus groups asked.

Another point of difference is that Maori did not ask anything about the application of the Stevia leaves or Stevia-based products. The explanation for this, once again, could be because of the time constraint.

Most of the participants in this focus group maintained that they would prefer to buy the processed products. However, most of them also said that they would like to grow their

own plant, but for cooking or baking they would prefer the processed products. Amongst the different products available, the respondents preferred the powder form because it is more like sugar and it is easier to use. They stated that the liquid extract may be easier to dissolve in liquids - but only that. Their opinion on the tablets was that they would just be good for drinks, not for cooking; and about the individual sachets of Stevia one participant said that the inconvenience would be that they do not last for long. Considering that the Maori use sugar as their main sweetener, it is understandable that they would prefer the powder form for their cooking and baking since, as was mentioned earlier, habits and traditions are hard to change. However, it is useful to know their opinions on the other forms as well and see their openness to other options.

4.6. Cross-Case Data Analysis and Discussion

Cross-case analysis is very important in any multiple-case study research to identify patterns (similarities and differences) that occurred across the different cases (Eisenhardt, 1989; Gray, 2001). The cases selected in this study were four different groups (general public, members of the Herb Society, diabetics and Maori). The opinions, responses and suggestions about Stevia and Stevia-based products of the participants in the four groups are presented, compared and contrasted in relation to the theory and concepts. First, the introduction part of each focus group is analysed: their knowledge of the existence of Stevia, what attracted the participants to Stevia and if they are interested in replacing their current sweeteners with Stevia. Second, the categories and subcategories from each group are compared and contrasted against each other. The similarities and differences between cases are explained.

4.6.1. General information about participants

For this section a total of 27 participants' responses were used (the sum of all participants of the four focus groups). Frequency Tables have been constructed to show the distribution of the different variables within the population.

Tables 4.8., 4.9. and 4.10. show that the majority of respondents were female (70.4%), belong to the Age Group of 50 years or more (55.6%) and were Caucasian (mainly New Zealanders) (63.0%).

Table 4.8. Information from the participants survey, gender distribution (N=27)

Gender	Frequency	Percent	Cumulative Percent
1- Female	19	70.4%	70.4%
2- Male	8	29.6%	100.0%
Total	27	100.0 %	

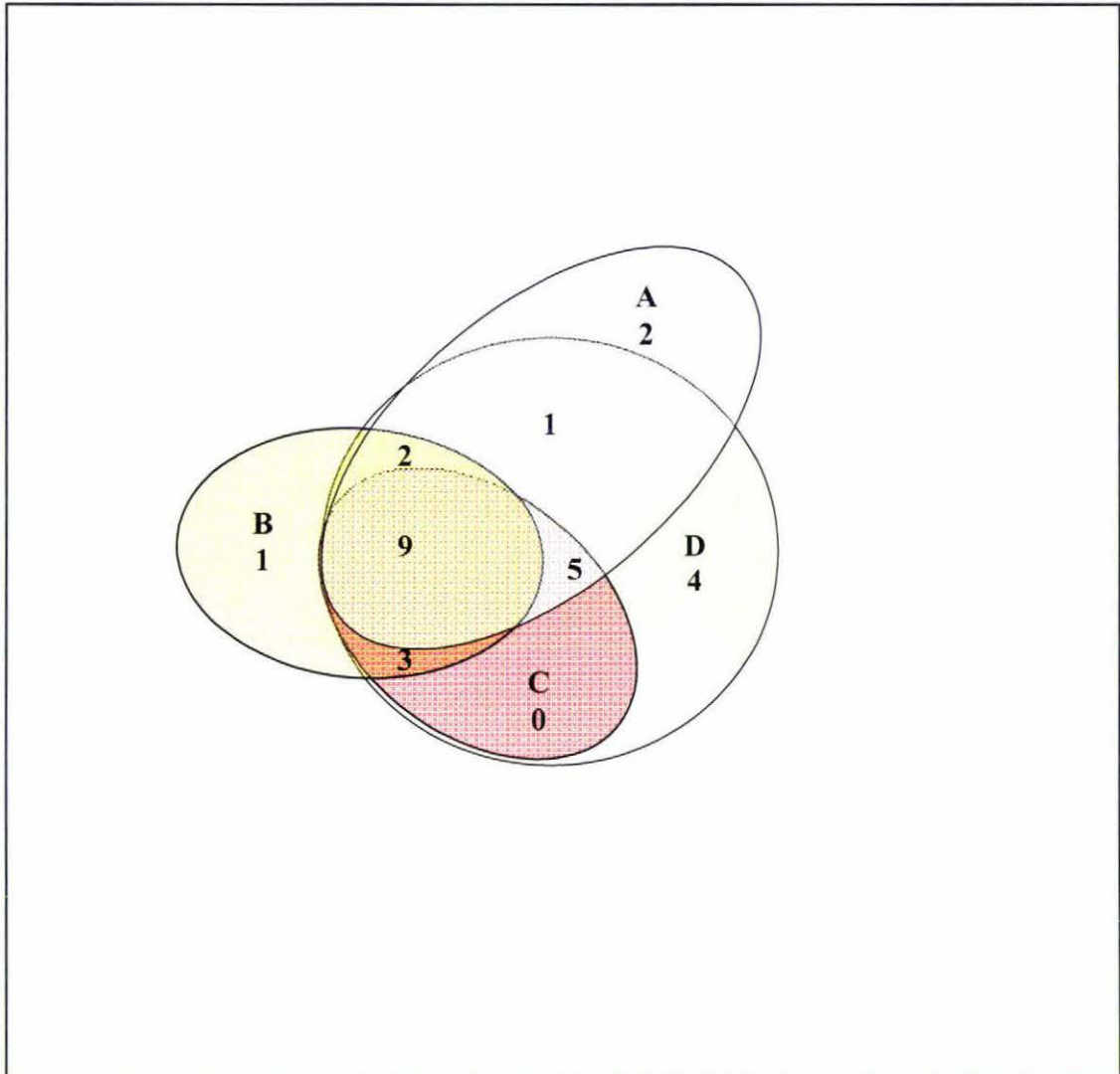
Table 4.9. Information from participants, Age group distribution (N =27)

Age Group	Frequency	Percent	Cumulative Percent
1) <18	1	3.7%	3.7%
2) 19-25	3	11.1%	14.8%
3) 26-35	3	11.1%	25.9%
4) 36-50	5	18.5%	44.4%
5) >50	15	55.6%	100.0%
Total	27	100.0 %	

Table 4.10. Information from participants, Ethnic Group distribution (N=27)

Ethnic Group	Frequency	Percent	Cumulative Percent
1) Caucasian	17	63.0%	63.0%
2) Maori	8	29.6%	92.6%
3) Latin	2	7.4%	100.0%
4) Others	0	0.0%	100.0%
Total	27	100.0 %	

Figure 4.2. Venn Diagram of participants' grouping according to three characteristics.



- **Set A:** Participants who are female;
- **Set B:** Participants who are 50 years old or older;
- **Set C:** Participants who are Caucasian; and
- **Set D:** Participants who are health conscious

It may be seen from the above diagram that the participants who are Caucasian all share at least one of the characteristics of sets A, B or D. In addition, only two participants who are female do not share any of the characteristics from sets B, C and D. The groups were composed as is shown below:

50 years old or older; five participants were Caucasian and one was Latin. All participants from this group said that they are health-conscious people.

- Herb Experts: five female, one male; three participants were between 36 and 50 and the other three were 50 years old or older; four participants were Caucasian, one was Maori and the last one was Latin. All participants from this group said that they are health-conscious people.
- Diabetics: seven female, one male; all eight participants were between 50 years old or older; all 8 participants were Caucasian. All 8 participants said that they are health conscious.
- Maori: three female, four male; three participants were between 19 and 25, two were between 26 and 35 and the other two were 50 years old or older; all seven participants were Maori. Four participants said that they are health conscious, two responded that they are not and one did not answer to the question.

One important remark is that all participants included in sets A, B and C (Caucasian females older than 50 years) share the common characteristic of being health conscious, which gives additional information for the marketing focus of this research.

Table 4.11. Information on the opinion about “sweetening” habits (N=27)

Questions	Extremely	Very strongly	Strongly	Moderately	Indifferent	No	Did not answer
Do you like sweetening?	3.7%	7.4%	7.4%	74.1%	7.4%	0.0%	0.0%

The majority of participants (74.1%) answered that they like sweet things “moderately”. All other categories were distributed in a similar way (see Table 4.11.). Amongst the groups analysed, the general public group was the one that had more people who liked sweet things; on the contrary, the diabetics group was the one that showed least enthusiasm for sweet food and beverages (see Table A.8. in Appendix 11). The participants were asked to identify what kind of sweeteners they use for their beverages and food (see Table 4.12.)

Table 4.12. Information about kind of sweeteners used (N=27)

Question	Sugar	Sugar Substitute	Sugar and sug.substit.	None	Did not answer
What sweeteners do you use in beverages?	44.4%	18.5%	18.5%	11.1%	7.4%
What sweeteners do you use for cooking/ baking?	44.4%	14.8%	25.9%	0.0%	14.8%

In the section about their current sweetener consumption (see Table 4.12.) responses showed that to sweeten their beverages and for their cooking and/or baking, 44.4% of all participants consume only sugar. Sugar substitutes are consumed by 18.5% for beverages and 14.8% for cooking and baking. Many participants combine both sugar and sugar substitutes for their preparations, 18.5% in beverages and 25.9% in their cooking or baking. In this respect, the herb experts and Maori are the groups which mostly consume sugar in their preparations (see Table A.9., Appendix 11). The general public group mostly combines both kinds of sweeteners and the diabetics mostly use sugar substitutes for their preparations (see Tables A.9., Appendix 11).

In Table 4.13. some general information about the consuming habits of the participants is given (mainly on their current sweeteners). They also were asked to analyse themselves in some health issues.

Table 4.13. Information about participants' sweetening habits and about opinion on Stevia (N=27)

Questions	Yes	No	Did not answer
Are you a health conscious person?	88.9%	7.4%	3.7%
Do you worry about your weight?	63.0%	37.0%	0.0%
Does your current sweetener have an aftertaste?	42.9%	57.1%	0.0%
Do you buy your sweeteners in health shops?	3.7%	88.9%	7.4%
Do you buy your sweeteners in the supermarket?	100.0%	0.0%	0.0%

Description of Table 4.13.

From all groups, 88.9% of the respondents said that they are health conscious and another 63.0% said that they worry about their weight (mostly women). The only group that did not have a 100% of responses of being health conscious was the Maori one (see

Tables 4.2., 4.4., 4.6., 4.7. of this Chapter). The group that responded that they worried 100% about their weight was the General Public one; all other groups had some participants who answered “no” to this concern, the Maori group had more participants that do not care than those who do care about the weight management issue (see Tables 4.2., 4.4., 4.6., 4.7. of this Chapter).

A high percentage of 42.9% of the participants replied that their current sweeteners leave an aftertaste, which is rather surprising because sugar is also included in that category. The Maori group was the one with the highest percentage (85.7%), which responded that their current sweetener does not leave an aftertaste (it is important to clarify that this group mainly uses sugar). The only group which had the majority of answers (62.5%) affirming that there is an aftertaste in their sweeteners was the diabetics group, which mainly uses artificial sweeteners (see Tables 4.2., 4.4., 4.6., 4.7. of this Chapter).

The totality of participants responded that they buy their sweeteners from the supermarket, but there is a low percentage (3.7%) which sometimes also buy them from health shops.

4.6.2. Participants' awareness of Stevia

The awareness of Stevia amongst participants differs from group to group. The researcher expected more negative answers to the question “did you know about Stevia before?”, since there are not many places that offer Stevia in New Zealand and because of the fact that Stevia-processed products are not recognised as sweeteners yet. The only group that had a 100% agreement in the answers of its participants was the Maori one, where there was no one who knew about Stevia. The group that had a majority of participants who were familiar with the herb was the herb experts' group. The two remaining groups (general public and diabetics) had similar results representing their awareness of Stevia.

The majority of participants in the General Public group had not known about the existence of Stevia before the focus group was held. One of them had read about Stevia and another participant grew the plant a few years ago.

In contrast, not unexpectedly most of the members of the Herb Society were aware of Stevia and its uses. However, the majority of members of all groups except Maori had some knowledge of the product.

Amongst the diabetics, fewer than half of the participants did not know or had not heard about Stevia before the focus group session. One of the participants who had known about it, recalled she had "...a friend who had a coronary implantation and he was using natural medication, and Stevia was part of his diet". Two others did not recall from where they had heard about Stevia, but they affirmed they had heard about it. Another one heard about it from her sister who worked in Massey University, who heard about the project from the researcher. And the last one said he first found out in the members' meeting when the researcher gave a short presentation.

And finally, in the fourth focus group – of the Maori, there was no one who had known or had heard about Stevia before the meeting.

4.6.3. Attractions participants found on Stevia

Different views were given when participants were asked "what drew their attention about Stevia?". These are summarised in Table 4.14.

Table 4.14. Responses about the issues that attracted participants to Stevia

Focus group	What drew their attention to Stevia?
1- General Public	Prepare drinks (cordial, lemonade) without adding a lot of sugar Replace the artificial sweeteners in diet soft drinks Get ready-made products that contain Stevia That it is natural and sweet That children can use it too with no harm to their teeth
2- Members of the Manawatu Herb Society	Cut down on sugar It is good for your health You can grow it It is natural It is good for the skin and wounds
3- Diabetics	It is sweet and natural You can grow it and look after it It is a herb Commercial growing and processing The cooking properties
4- Maori	There were no answers to this question since they did not know about Stevia

As can be noticed in Table 4.14. there were shared answers amongst the different groups. In this sense, participants were attracted to Stevia because 1) it is sweet and natural; 2) it can be used for cooking and baking; 3) it cuts down the sugar intake; 4) it is good for health and 5) you can grow it by yourself. Taking into consideration these answers it can be assumed that the people who are interested in Stevia are health conscious, have a disease that limits them to certain kinds of sweeteners (for example diabetes, candida, hypoglycaemia, etc.), like natural and healthy foods.

4.6.4. Opinions on replacing current sweeteners with Stevia:

This research project aimed to ascertain the opinions of the participants in specific groups on their willingness to replace their current sweeteners with Stevia. This section presents those opinions and the differences and similarities amongst the groups' participants on this issue.

As an introduction to the answers of the participants about their willingness to replace their current sweeteners with Stevia, Table 4.15. presents their opinions on the food and beverages (prepared with Stevia products) that they had tried in the workshop.

Table 4.15. Opinions on the food and beverages prepared with Stevia

Questions	Yes	No	Did not answer
Do you like the snacks you tried?	96.3%	3.7%	0.0%
Do you like the beverages you had?	92.6%	0.0%	7.4%
Did you feel an aftertaste?	37.0%	55.6%	7.4%
Would you sweeten your foods and beverages with Stevia?	85.2%	7.4%	7.4%

Description of Table 4.15.

A very high proportion of the participants responded that they liked the snacks (96.3%) and the beverages (92.6%) prepared with Stevia-processed products. From these percentages the only group that did not like the preparations a 100% was the Maori one (see Tables 4.2., 4.4., 4.6., 4.7. of this Chapter). A noteworthy point is that there were no negative responses to the beverages sweetened with Stevia.

Of all the respondents 37.0% could taste an aftertaste in the food and beverages prepared with Stevia-based products, however some of them said that it was a “pleasant” aftertaste. In three of the four focus groups the minority of respondents said that they felt an aftertaste (33.3% in the general public, 25% in the diabetics and 0 % in the Maori). In the qualitative analysis there were some negative answers about the presence of an aftertaste, but in their questionnaire responses all of them felt an aftertaste. (see Tables 4.2., 4.4., 4.6., 4.7. of this Chapter).

And finally, to the question if they would sweeten their foods and beverages with Stevia, 85.2% answered they would; only 7.4% of the participants said they would not use Stevia and the last 7.4% did not answer the question.

In Table 4.16 the different responses on the possibilities of using Stevia as a sweetener are given for each group (the answers were taken from the questionnaires the

participants had at the end of each session). All participants in the herb experts' and the diabetics' groups and five in the general public group had an affirmative response to this question. Four participants in the Maori group said they would use Stevia to sweeten their food and beverages, but two of them did not answer this question.

Table 4.16: Responses of the four groups about the possibilities of sweetening their food and beverages with Stevia

Would you sweeten you foods and beverages with Stevia?	Yes	No	Did not answer
General Public	5	1	0
Herb experts	6	0	0
Diabetics	8	0	0
Maori	4	1	2

The different groups were analysed and four different reactions were collected about the replacement issue. First, there were the diabetics who unanimously responded that they are interested in replacing their current sweetener with Stevia. Second, there were the members of the Herb Society who also showed a lot of interest and positive reactions towards Stevia, but they had some doubts and pointed out some negative points such as lactose intolerances, using the green form and the negative reactions of certain type of people (like children) to the appearance of the preparations. Third, the general public group, which showed interest and willingness to try it, but were waiting to make a decision after getting more information about different areas. And finally there was the Maori group, which suggested they first need to try it and experiment with it before giving any opinion or making a decision. It can be said that the responses during the session coincide with what the questionnaire's results show in Table 4.16.

The researcher assumed that the diabetics and Maori would be the most receptive and interested groups: most of the diabetics recognised this fact - on the contrary, most Maori showed some indecision about their buying behaviour (this could be because none of them had known about it before). The herb experts also gave a positive reaction towards Stevia as had been predicted. The general public group had a more positive response than had been expected since they said they are interested and willing to change.

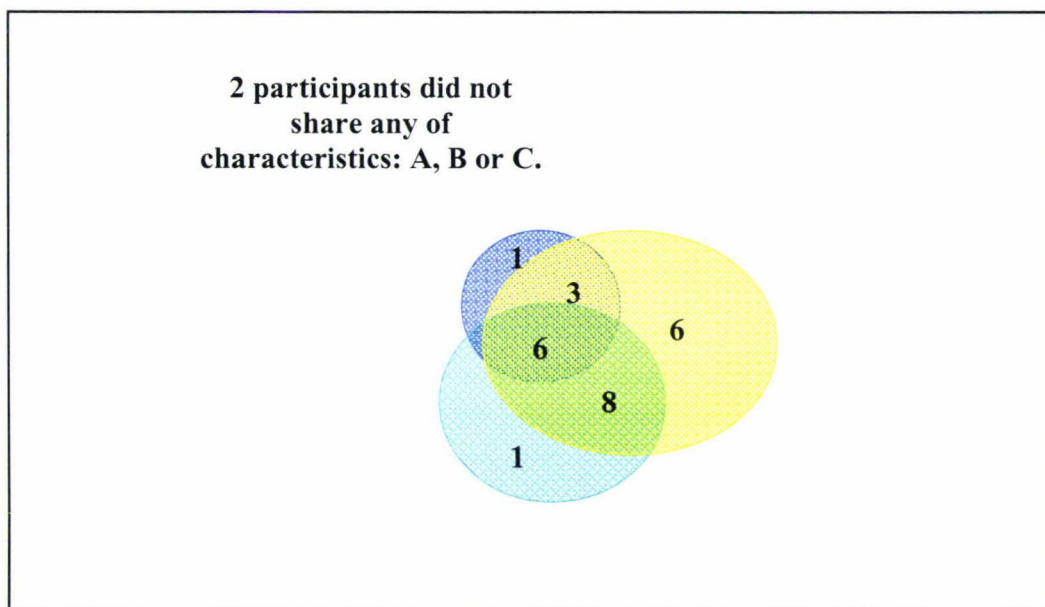
The first group, the general public, had a majority positive answer when the participants were asked if they were interested in replacing their current sweetener with Stevia. Most of them said they would try it, however, there was one participant who said she would like to have some more information about the reasons why she should use it, how to cook with the leaves and how to use it, before answering the question. The members of the group were interested in trying the products. Once they had tried it, they would decide if they were going to replace their current sweeteners with Stevia. A major problem they perceived is that the products are not readily available in all parts of New Zealand yet, so even if they were interested in changing their current sweetener, that would not be possible because there is almost no Stevia to replace them with.

The members of the Herb Society had different points of view towards the question if they would replace their current sweetener with Stevia. This group took into consideration that there were two possibilities in using Stevia as a substitute for their sweeteners: 1) the Stevia-based products and 2) the leaves (whole, cut or ground). Some of the respondents agreed that they would prefer to buy the processed products, without discarding the idea of using the green form. There was a negative point mentioned about using the green form: that some people might not like the appearance of the food and the remaining of the leaves (especially children and conventional people), however, they would use the processed forms for these cases. The participants stated that they would prefer to have it “*green*” and have “*reusable*” ingredients. One of the participants explained that she would be happy changing but that her family had lactose intolerances, therefore products that contained lactose as fillers would not be her option.

The third group, the diabetics, had a unanimous response to this question. All participants in this group said that they are interested in replacing their current sweetener with Stevia either in its natural form or the processed products, or both combined. These responses bring to light that the diabetics are not satisfied with their current sweeteners (mostly artificial sweeteners). They made many comparisons of Stevia with the sweeteners they are consuming and what mostly attracted them was that Stevia is a naturally occurring sweetener, that you can grow it and that you can cook with it.

Contrary to the previous group, the Maori participants had a different reaction to this question. Since it was the first time for all participants to hear about Stevia, they were not sure yet about their answers because they just tasted some of the food and drinks. The majority of participants answered that they were interested, but that they would like to try it first. There was one participant who answered negatively. The researcher came out with one doubt after concluding this focus group: would it have been different if there had been someone or more than one who had known about Stevia in this group?

Figure 4.3. Venn Diagram of participants' grouping according to three characteristics.



- **Set A:** Participants who knew about the existence of Stevia;
- **Set B:** Participants who did not feel an aftertaste; and
- **Set C:** Participants who liked the food and beverages prepared with Stevia-processed products and who are willing to replace their current sweeteners with Stevia.

On the above diagram participants are grouped according to the defined characteristics. If some participants shared both characteristics, for example A and C, then a group of these participants is represented in the part of Venn diagram represented by interception of correspondent sets (3).

Six participants shared all three characteristics and are presented in interception of all three sets A, B and C. Two participants did not have any of the three characteristics and they are represented by the area that is outside of all three sets. One participant who had known about Stevia before reported that she was not willing to replace her current sweetener with Stevia. Another participant who did not feel an aftertaste was also not prepared to replace his current sweetener with Stevia. Six participants who reported liking and being willing to use Stevia were not included in the other sets (A and B).

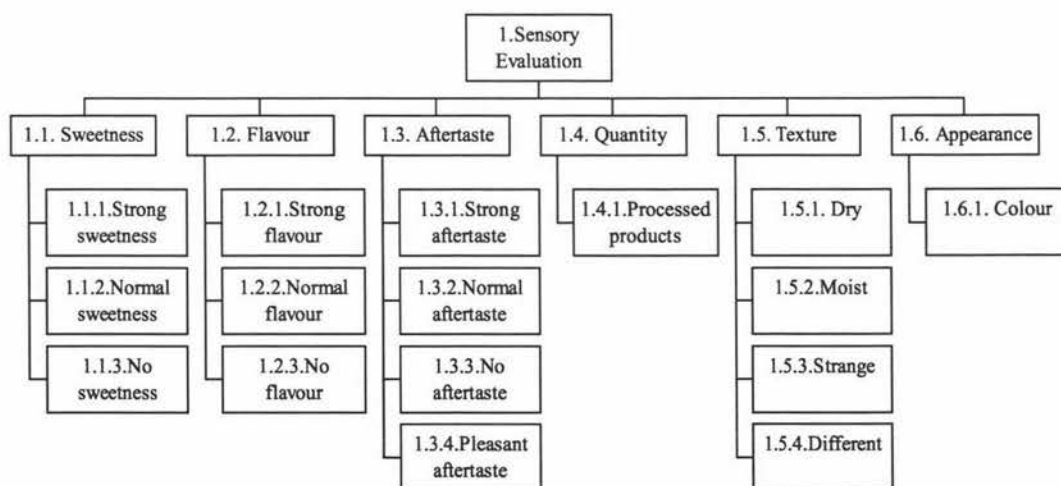
4.6.5. Potential use of Stevia amongst the four groups

This part of the cross-case analysis will follow the same order as the results were presented in the within-case analyses, this is: 1) Sensory Evaluation, 2) Market Issues, 3) Health and Research Issues and 4) Convenience.

1. Sensory Evaluation

In all four groups, issues concerning the sensory evaluation were discussed (see Figure 4.4.).

Figure 4.4. Answers given to the different issues concerning the Sensory Evaluation



In order to compare and contrast the different groups, and the different issues, the researcher classified the different answers of the respondents and included them into subcategories.

The three classifications of sweetness are: very strong, normal and no sweetness. The three first groups (general public, herb experts and diabetics) had very similar opinions on the sweetness issue. They noticed a “strong sweetness” of Stevia. In the general public and diabetics group there was one participant who thought it was “*too sweet*” and in the group of the herb experts there was one participant who said it was sweet “*but not that sweet*”. The fact that these three groups thought the food and beverages were very sweet may be the result of the following causes:

- 1) The proportion suggested of Stevia is too high;
- 2) The recipes being from Paraguay might be too sweet for New Zealanders since the Paraguayans like very sweet things; and
- 3) Related to point 2, the habit of sweet things might not be that usual amongst these people.

The last group, the Maori, differed from the other groups in that the sweetness was “normal to not so sweet”. This situation may have different explanations, ranging from the habits of sweetness, culture, taste sense, or as said before maybe Maori like food and drinks sweeter than the Paraguayan do, therefore the recipes were not sweet enough.

The flavour had the same classification as the sweetness: strong, normal or no flavour. The three first groups again agreed on this issue, finding Stevia to have a “*normal flavour*”, describing it as “*nice, good, not altered nor bitter*”. The diabetics were the most pleased with the flavour because they complained about the aftertaste of the artificial sweeteners they normally use. However, there were one or two participants who said it was tasteless or neutral. The Maori did not make many comments on this, but the ones who did, found the flavour to be all right and different from what they are used to.

Taking the literature into consideration there were few reactions on this issue, because what people do automatically is compare the flavour with what they are used to. In these cases only two or three participants compared Stevia with sugar, and their reaction was that it “*was not too different*”. There were no comments about a bitter or sour taste as can be found in the literature.

The classifications for the aftertaste are: strong, normal, no and pleasant aftertaste. There is more diversity amongst the participants of the groups than between groups when this issue is analysed. This situation is what the literature also points out, that there are persons who can taste an aftertaste and others who do not. The general public and the Herb Society members had two separate groups, one that said there is “no aftertaste or a pleasant aftertaste” and another one that said “strong aftertaste”. The diabetics and Maori maintained there was “no” aftertaste. As was mentioned before the reason why the diabetics do not feel an aftertaste might be because they use artificial sweeteners and on these they do taste an unpleasant aftertaste, they confessed.

The general public, Herb Society members and diabetics were concerned about the Quantity issue. All of them wanted to find out how to calculate and measure Stevia for their cooking and baking. In the Maori group there was no one who asked something about this issue. Although a table of conversion was included in the packs participants were given, the researcher considers this table to be just a guide, since as was explained before, the taste sense differs very much amongst different kinds of people, and therefore a specific table of conversion should be elaborated for each case.

Another point of interest for the majority of groups was the texture of the food prepared with Stevia-processed products. The first two groups (general public and herb experts) made several comments about the texture, mainly that it was different from what they are used to, dry, and strange. However, they came up with the idea that it might be the recipe and not Stevia, which was affirmed by the researcher who explained that the recipes used were Paraguayan. The other two groups did not pay a lot of attention to this issue.

And the last point of the Sensory Evaluation was the appearance of the food and drinks prepared with Stevia-based products and with Stevia leaves. The herb experts’ group said that the colour of some of the drinks was different and they questioned if this was caused by the Stevia or the fillers; they also suggested that when Stevia leaves are used for cooking, some people (especially children) might not like the green colour and remaining of the leaves. If the appearance was different, the causes might have been that

the leaves were used to prepare the drinks, but in no way can it be said that the processed products changed the colour, since as was seen in the literature, these do not change the appearance of the goods prepared. There was one participant in the diabetic group who also commented on the colour, but just for information matters. The processed products have almost the same properties and characteristics as other sweeteners have, and in the appearance issue, it is said that they do not change the colour or appearance of the preparations. On the contrary, when the leaves are used to sweeten things (either dried, fresh or the home syrup), they will change the colour of the preparation and depending on what is used they will also leave some remanent. The general public and the Maori groups did not make any comments on this issue.

2. Market Issues

The main subcategories of this category were discussed in all four groups, but there were some differences in the views and interests of the participants in each group. The first market issue analysed is Information. The answers collected can be observed in Table 4.17.

Table 4.17. Comparison of the four groups and their interests on the Information issue:

1- General Public	2- Herb experts	3- Diabetics	4- Maori
<ul style="list-style-type: none"> ➤ How do you use the processed products? ➤ How do you cook with Stevia leaves? ➤ Is it heat stable? ➤ How do you cook with Stevia powder? ➤ What are the reasons why it should be used? 	<ul style="list-style-type: none"> ➤ Extraction methods and the extraction process of Stevia. ➤ Can children consume Stevia? ➤ How does Stevia react when mixed with other flavours? ➤ What fillers are used, how they react, etc. 	<ul style="list-style-type: none"> ➤ Recommended quantities, ➤ Health issues ➤ Place, price, products and the plant ➤ Growing and uses. ➤ How to utilise the products, ➤ How to dry the leaves? ➤ What fillers do the manufacturers use for the processed products? 	<ul style="list-style-type: none"> ➤ How well is Stevia doing as far as sales? ➤ Where is it grown commercially? ➤ Where are the Stevia-based products produced? ➤ What fillers do manufacturers use for the processed products?

The level of knowledge about Stevia, the lifestyle and the interests play an important role when it comes to asking for information about it. This fact explains the differences

amongst the groups. As can be seen in Table 4.17., the general public group was more interested in finding out about the uses and cooking properties of the Stevia plant but even more about the processed products. The herb experts are well known for their knowledge on herbs, therefore the kind of information requested by them was different and included: extraction methods and process, consumption by children, reactions of Stevia when combined with other flavours, and so on.

The three last groups (herb experts, diabetics and Maori) asked about the fillers used in the processed products (especially powders and bulk forms). The interest in this could be explained by the fact that there are some intolerances with some of the fillers, especially with lactose and F.O.S. (Fructo-oligosaccharides) (Kirkland, 2000) as was the case of two participants in this project. The diabetics group was the one which showed interest in various areas including health and marketing issues, growing, uses, and so on; this interest may suggest that they were really thinking of replacing their current sweeteners with Stevia. The Maori asked some different questions such as production figures, sales and origin of the products, which could be taken as an indication that they were not interested in knowing more about a potential sweetener for their own use.

2.1. Marketing Issues

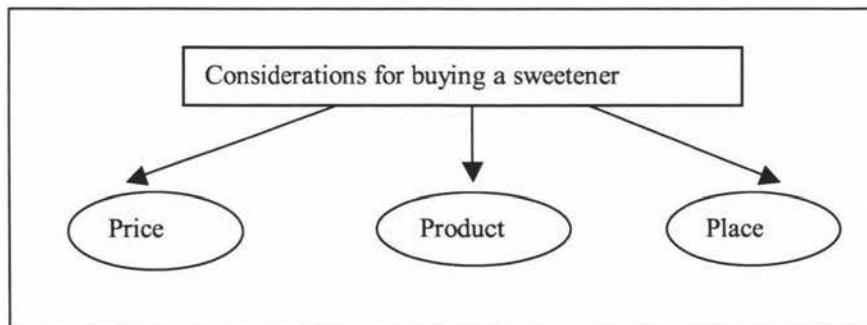
When it came to the Marketing issues, there were some differences in the answers the groups gave about the importance they give to the price, product and place when deciding to buy their sweetener (see Figure 4.5.). The general public and the Maori groups for example, considered the price being the most important thing when it came to buying a sweetener. Some of them revealed that Stevia looked expensive to them, but that quantity also determines its convenience or otherwise, because it seems that less is needed compared with other sweeteners.

The diabetics had some conflicting answers about these issues. First, they indicated that the price plays an important role for them when they buy their sweetener, but then they explained that they look at other, different, characteristics of the product to decide whether to buy it or not, such as the content, the form and the quantity required. Finally, there was the group of the members of the Herb Society, who revealed they do not give

a lot of importance to the price but to the product (characteristics such as content, form, quality, etc.) because they said it has to satisfy their needs and wants.

The place where to get Stevia and its availability were common concerns amongst all four groups. Participants insisted that if a product is not available in the place the customer wants it, it is very unlikely that the product will have success. The only group which did not find the availability to be a major constraint was the Herb Society members' group, because they are better informed and visit the nurseries and health-shops more often. Many participants were disappointed that Stevia is not freely sold and that it is still not accepted as a sweetener in New Zealand.

Figure 4.5. Marketing issues considered to be important when buying a sweetener



2.2. New Products

The researcher asked each group to come up with suggestions of new products that could contain Stevia. Each group had some ideas, some of them common with those of another group and some of them different. The diabetics and Maori groups were the ones who gave fewer ideas about this issue. Table 4.18. presents all new products that were listed in the four different groups.

Table 4.18. New products cited by the participants of all four groups:

New Products	General Public	Herb Experts	Diabetics	Maori
1.2.3.1. Drinks	Cordial, lemonade, soft drinks, juices and hot drinks (tea, coffee)	Fruit drinks, children's drinks, cordial, lemonade	Soft drinks, general drinks	No suggestions
1.2.3.2. Bakery	Breads and cookies would be good products containing Stevia	Biscuits, pastry	Baked products	No suggestions
1.2.3.3. Sweets	Lollies and chocolate with Stevia	Preserves, gummy bear type of things, chewing gums, bubble gums	No suggestions	Toffee and fudge
1.2.3.4. Dairy Products	No suggestions	Ice-cream	Dairy products	No suggestions
1.2.3.5. Others	Rhubarb, sauces and cereals	Jam, drink sachets, toothpaste, skin products, vitamin C tablets. End products for diabetics	Muesli bars, jam	Jam and skin products

The most cited products amongst all groups were drinks (cordial, fruit drinks and soft drinks), bakery goods (biscuits, cookies), sweets (lollies, chewing gums), dairy products, and others (jam, skin products, and cereals). Beside all these, some of the participants (out of context) said that if Stevia was added to any food as a sweetener they would be interested in trying it. This could open a potential market for this sweetener - the industries. Japan is the country that has the most diversified products containing Stevia, almost all products listed by these groups are amongst them, this information could be useful for people interested in importing ready-made products containing Stevia or for interested New Zealanders in an exportation market.

If these groups were considered to identify the competition for Stevia in New Zealand, there would be two main contenders: sugar and artificial sweeteners. Sugar was the most cited amongst the participants of the general public, herb experts and Maori groups. Many of the participants of these groups were aware of the artificial sweeteners but most of them did not use them because of the side effects and the bad comments. The diabetics, for obvious reasons, had a different alternative to sugar, artificial sweeteners. Not being satisfied with these and being aware of the side effects that these cause, they mentioned some disadvantages about them. All groups were aware of the disadvantages sugar and artificial sweeteners have; however they also listed some of the advantages.

The researcher illustrates these in Figure 4.6. to make a quick comparison between the different alternatives: sugar, artificial sweeteners and Stevia.

Figure 4.6. Comparison of Stevia with the two main commercial sweeteners used in New Zealand, according to the participants; responses:

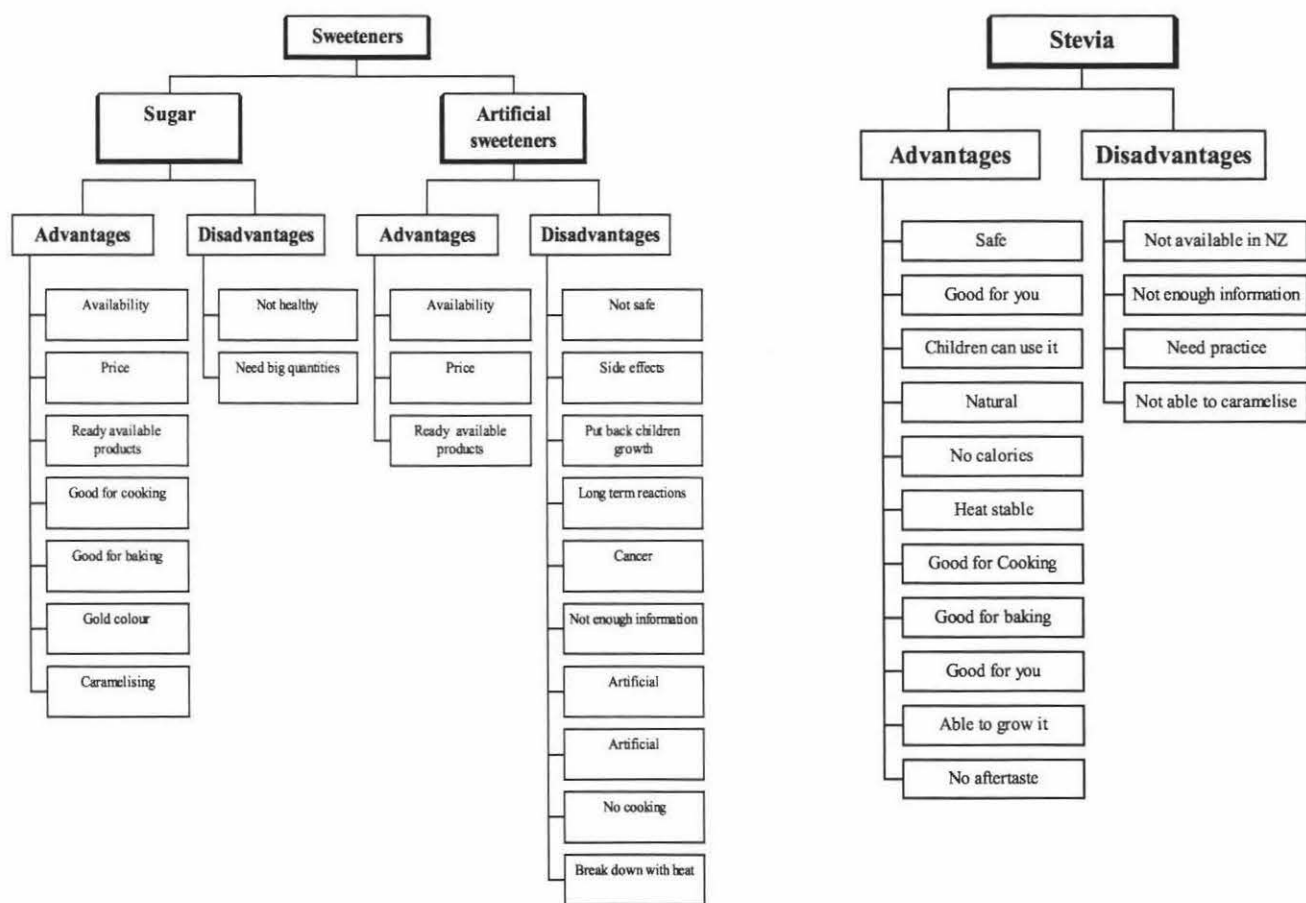


Figure 4.6. presents all advantages and disadvantages that participants listed about their current sweeteners sugar and artificial sweeteners. Stevia's advantages and disadvantages, however, were not only inputs from the participants, but also from what the researcher presented at the beginning of each focus group session. The most cited advantages of sugar were the price, the availability, the cooking and baking properties and that it caramelises. Its disadvantages are that it is not healthy and that big quantities are required. Participants said about the artificial sweeteners that they are available, not

expensive and that ready-to-eat products contain them. However, many disadvantages were found: not safe, side effects, long-term bad reactions, not heat stable, amongst others. The main things that drew the participants' attention about Stevia were: it is natural, has no calories, it is suitable for diabetes and other health problems, that children can take it too and that it is heat stable and good for cooking, etc. However, they did not like the facts that Stevia and Stevia-based products are not available everywhere in New Zealand, that there is not enough information and that it does not caramelize.

Participants were asked if they use sugar substitutes and how often. The different answers are given in Table 4.19.

Table 4.19. Responses of all groups about their sugar substitute consumption

Do you use sugar substitutes?	Always	Often	Sometimes	Never	Did not answer
General Public	1	1	3	1	0
Herb experts	0	1	2	3	0
Diabetics	0	1	6	1	0
Maori	0	0	2	5	0

The general public and the diabetics are the groups which consume more sugar substitutes according to the results. The diabetics, as said before, use mainly artificial sweeteners; with the general public group the situation was different because they said that they do not use artificial sweeteners, so honey and/or others would be the options for them. The Maori group was the one which had fewer participants who use sugar substitutes, followed by the herb experts' group.

3. Health and Research Issues

Health and Research Issues were a common concern amongst the groups. Members of the different groups expressed the fact that they had doubts about some specific points in these areas.

The general public and Maori groups did not ask or mention anything specific about Safety issues. On the other hand, the herb experts and diabetics were concerned about it and wanted to find out the recommended intake, if it was safe for children and what the health professionals' opinions were about Stevia.

An important point was that three groups (excluding the diabetics), automatically found a relation of Stevia with diabetes, stating that if approved, Stevia would be a good thing for that specific group. All four groups considered the health issues to be very important. Different aspects were stressed by the participants, the general public and the herb experts' groups agreed that Stevia is good because it replaces the sugar intake and it is good for general health. Other areas of interest were: consumption by children, recommended intake, benefits, teeth health, weight problems, and so on.

The diabetics' group suggested it would be good as an artificial sweetener substitute that also was envisioned by the general public and herb experts' groups. All four groups agreed that there should be more Research done, even in New Zealand, some of them said. The obesity issue was considered only by the Maori group; the participants agreed that for this matter it would bring many benefits, however, the Maori was the group with the lowest percentage of participants concerned about weight.

4. Convenience

The first three groups that were analysed (general public, herb experts and diabetics) shared the interest about issues relating to growing plants. Members of the three groups asked questions about propagating, caring, places where to grow the plants and other general issues concerning the growing matter. The Maori group - despite their tradition in growing things (Ngā Tipu Whakaoranga infobase, 2002) - did not show interest in these issues, as the other groups did. The same pattern happened with the application issues, the first three groups uncovered issues such as uses for the plant and different processed products. On the contrary, the Maori did not ask or mention anything about application matters.

All four groups agreed that the preferred form in processed products is the powder form. They listed reasons such as being a dry ingredient, easier to use, more like sugar, being a tradition in cooking and baking to be important characteristics. The four groups also agreed in the interest to grow their own Stevia plant. Other forms were discussed, but had no relevant importance.

CHAPTER FIVE**CONCLUSIONS AND RECOMMENDATIONS****5 – CONCLUSIONS AND RECOMMENDATIONS****5.1. Introduction**

Stevia rebaudiana (Bertoni) is a naturally occurring non-caloric sweetener that has become a significant competitor to artificial sweeteners and refined sugar. The hypothesis proposed in this study has been tested and indicated that most of the participants of selected consumer groups of New Zealanders are prepared to accept and use Stevia and/or Stevia-based products.

From the literature review and the results of the research, it can be concluded that there is a demand for Stevia in New Zealand. The reasons why this demand is unfilled are included in the findings of the research. A broad market situation of Stevia is presented below:

- Stevia is used as a sweetener in many countries around the world, mainly as a substitute for artificial sweeteners. Recent research has shown that some artificial sweeteners may be considered unsafe (Weihrauch, Diehl & Bohlen, 2001; Midmore & Rank, 2002). These findings have contributed to the growth in the use of Stevia as a substitute for these artificial sweeteners. In Japan artificial sweeteners are banned and, in comparison, Stevia represents 41% of the sweetener market (Bonvie et al., 1997a). Japanese food processors use Stevia and its products in a wide variety of applications.
- In a number of countries, Stevia is desirable as a sweetener mainly because it is natural, it has no calories, it is safe for diabetics and it is heat stable.
- In New Zealand, however, Stevia is neither well known nor used. The FSANZ (Food Standard Australia – New Zealand) position on Stevia is that the natural forms of the plant (whole leaf, crushed leaf) are considered to be a food and can be legally sold in New Zealand. But, Stevioside or other concentrated extracts of

Stevia are not allowed to be used or sold in Australia or New Zealand as sweeteners. In this sense, Stevia processed forms are not widely or cheaply available as a sweetener or food additive in New Zealand. But, the artificial sweeteners (aspartame, saccharin, cyclamate, etc.) are legally sold as sweeteners and are freely available in New Zealand.

- Stevia-processed products are only available as Dietary Supplements in only some of the health shops around New Zealand.
- There is a high rate of diabetes in New Zealand, which, when combined with an increasingly health conscious population, increases the potential of Stevia's use as a sweetener. Consumers who are not aware of the properties of Stevia (natural, heat stable, safe for diabetics and non-caloric) may be interested in it as a sweetener replacement when they become aware of its properties, happened with participants in research focus groups. However, for Stevia to be more widely available in New Zealand, a change in regulations is required. As noted above, FSANZ only accepts the natural form stevia to be a food, not processed Stevia.

In view of the above, research was undertaken to answer the following questions:

1. How well known is Stevia amongst New Zealanders?
2. What are the reactions and opinions of selected groups of New Zealanders about Stevia?
3. If these selected groups of New Zealanders were willing to replace their current sweeteners with Stevia; and
4. What Product Development Process may be used for the introduction of Stevia in New Zealand?

The research used multiple case studies that were first analysed and evaluated separately. The case studies were then evaluated using Cross-Case Analysis. Four focus group sessions were used for the data collection (general public, herb experts, diabetics and Maori). The overall aim of this thesis was to determine if the Stevia plant and/or Stevia-based products would be accepted and used as a sweetener by selected groups of New Zealanders. This was achieved by addressing the following objectives:

1. Determine if selected groups of New Zealanders exhibit a willingness to use Stevia and/or Stevia-based products as an alternative sweetener;
2. Determine if selected groups of New Zealanders are willing to replace their current sweeteners with Stevia and/or Stevia-based products;
3. Determine Stevia preferences amongst selected consumer groups in New Zealand;
4. Describe a possible Product Development Process for Stevia and Stevia-based products; and
5. Compare the results of the study to the literature.

In this chapter the conclusions from the study are outlined, the implications of the research are discussed and the research methodology is evaluated. Finally, areas of further research are identified.

5.2. Research Conclusions

5.2.1. Objective One:

The first objective of the research was to determine if selected groups of New Zealanders are willing to use Stevia and/or Stevia-based products as an alternative sweetener.

Members of the first three focus groups (general public, herb experts and diabetics) were more interested in using Stevia as a substitute for their current sweeteners than the Maori group. The participants of the general public and Maori groups said that they would replace their current sweeteners with Stevia but that they would like to have some more information about it. In both the herb experts and diabetics groups, members unanimously replied they consider Stevia a good alternative sweetener.

In New Zealand many people are not familiar with Stevia. The research indicated that when people became aware of its properties, they became interested in learning more.

Collected information was arranged into categories that were developed using the Qualitative Data Analysis method. The main categories were:

1. Sensory Evaluation: sweetness, flavour, aftertaste, texture, quantity and appearance;
2. Market Issues: price, product characteristics and place;
3. Health and research issues; and
4. Convenience: growing issues, application and form preferences.

The first category analysed was “Sensory Evaluation”. As expected, most of the participants could taste the sweetness of the food and beverages prepared with Stevia-based products and did like the flavour of the products, with the majority of the participants not noticing an aftertaste. Some of the participants did, however, sense an aftertaste. These results concurred with those of the literature review.

Other issues considered in the Sensory Evaluation category were the quantity, texture and appearance of Stevia. All groups concluded that these three issues did not depend on Stevia but on the recipes used, quantity, combination with other products, ingredients, quality, and fillers. One issue that was highlighted was the use of the leaves in cooking and baking (especially by the herb experts). They said they liked the idea of using them but that the green little pieces “might be an off-put” for some people (especially children).

An important contribution from this study is that selected groups of New Zealanders showed that there is a potential market for Stevia in New Zealand. The responses of these people were positive towards the food and beverages prepared with Stevia-based products.

The second category analysed was “Market Issues”. The sub-category “information” was a matter that varied considerably from group to group:

- The members of the general public focus group were interested in cooking and application issues;

- The herb experts were interested in getting more information on extraction methods, fillers used in the sample products, Stevia's performance when combined with other ingredients and Stevia's suitability for children;
- The diabetics group asked more diverse questions than other groups, ranging from the recommended quantities of Stevia, health issues, growing and application issues, leave drying methods and fillers used in the products;
- The Maori were more interested than other groups in the commercialisation aspect of Stevia. Examples of this interest were questions such as where Stevia is grown commercially, where the processed products are produced and how much Stevia is being sold, among other questions.

The three Marketing Issues (price, place and product) considered for this research were a common concern for all participants. For the general public and Maori groups the price was the most important issue when deciding to buy a sweetener. On the other hand, the herb experts said that the product characteristics were more important for them than price. Members of the diabetics group held a more moderate view in which both the price and the product characteristics are important.

Participants made a number of comments about Marketing of Stevia. Many suggestions were made on what range of products containing Stevia as a sweetener might have consumer demand. Participants listed among these products a variety of foods such as cereal bars, beverages such as soft drinks, and other products (cosmetics for example).

An important contribution made by the participants was the identification of the competition to Stevia in New Zealand. Three of the four groups said that sugar was their main sweetener but that they also knew that artificial sweeteners are consumed and contained in most diet and low-calories products. The diabetics group was the only one that mentioned artificial sweeteners as the main competitor for Stevia. In this respect, participants identified several advantages and disadvantages of sugar and artificial sweeteners comparing them with the advantages and disadvantages of Stevia that they learned during the introduction at the focus groups.

The third analysed category was the “Health and Research Issues” that included safety, research, obesity and diabetes.

Diabetes is considered to be a world epidemic and is the fourth leading cause of death in most developed countries. It is estimated that diabetes accounts for between 5% and 10% of a nation's health budget (International Diabetes Federation, 2003). The risk of cardiovascular death, high blood pressure, raised blood lipids, obesity, amongst others, is higher among people with diabetes. In New Zealand, the rates of diabetes and obesity are of concern (especially among Maori). In this sense, according to the literature review, Stevia's attributes of being beneficial for all of the above listed problems could be a reason for the acceleration of its commercialisation and use in New Zealand. The effects of Stevia's introduction into New Zealand might not only have positive health and societal benefits but it could also reduce the economic costs of diabetes and obesity for the New Zealand Government budget, by contributing to prevention of diabetes and obesity and better nutrition (International Diabetes Federation, 2003). The research showed that people were interested in the potential health benefits of Stevia for managing diabetes and for healthy living.

A summary of what participants discussed on the Health and Research Issues, during the focus group sessions is giving below:

- Participants of the General Public group believed that if Stevia is safe for diabetes, its use could have potential applications in New Zealand. They also referred to the obesity problems and said that the population of New Zealand could benefit by cutting down the sugar intake.
- The herb experts were interested in knowing about children's recommended Stevia intake and in the benefits to New Zealanders if Stevia replaced or reduced sugar consumption; the group also mentioned other issues such as: diabetes, and wished to learn more about recent research that has been done on Stevia.
- The diabetics liked the idea of having an alternative sweetener to the artificial sweeteners they were using, without the side effects the latter are said to have. Participants said that they would like to have more information on safety and research issues, and if possible from New Zealand sources.

- The Maori showed interest in the use of Stevia for losing weight, for diabetes and liked the fact that it was being used for dental health; however they said that they would like to have more information about Stevia before adapting it.

The final category analysed was “Convenience”. Participants of all four focus groups were interested in Stevia growing issues. Most of them said they would like to grow their own Stevia plant. Additional details of this category are discussed in the third Objective.

5.2.2. Objective Two:

The Second Objective was to determine if selected groups of New Zealanders are willing to replace their current sweeteners with Stevia and/or Stevia-based products.

The diabetics group was the most positive one in considering the replacement of their current sweeteners with Stevia. The participants of this group were not satisfied with the artificial sweeteners they are allowed to use, complaining about the aftertaste, the side effects and the fact that it is not possible to cook or bake with some of them. This situation might be the first step of considering this group of people to be a potential market for Stevia and Stevia-based products. The Maori, however, were more reluctant to change their habits of consuming sugar, because, they said, Stevia does not have some of the properties sugar has (caramelising, gold colour, availability, etc.). Most of the participants of the other two groups analysed responded they are willing to replace their current sweetener with Stevia. Some, however, said that they would like to have some more information about Stevia.

5.2.3. Objective Three:

The Third Objective was to determine the preferences among selected consumer groups in New Zealand for the type of Stevia consumed. The preferred Stevia form for all four groups was powdered Stevia. The main reasons given by the participants for their decisions were that the powder form is a dry ingredient like sugar, which makes it easier to use and to measure. They also highlighted the point that using a dry ingredient is a tradition in cooking and baking, which would be difficult to change. However, all

groups also agreed that in addition to the powder, they would like to grow their own Stevia plant. The other forms in which Stevia might be consumed that were mentioned during the sessions were liquid extracts, sachets, tablets and teabags.

5.2.4. Objective Four:

The Fourth Objective was to describe a possible Product Development Process (PDP) for Stevia and Stevia-based products for the introduction of Stevia into New Zealand. As a prototype PDP, a Paraguayan Stevia situation (country of origin of Stevia) was considered and described. According to the findings, Stevia's development in Paraguay failed several times (it was first scientifically classified in 1887) because it did not follow a PDP. At present, the private sector in Paraguay is attempting to develop this crop and industrialise it, with better-defined plans for the near, medium and long future. It was determined that it is recommended to follow a PDP. Not to do so may result in the situation going out of control (as it happened in Paraguay) resulting in a loss of time and money.

Summarising, information collected and analysed from focus group discussions showed that Stevia has potential in New Zealand as:

- A sweetener that may be grown on your own: having a Stevia plant allows growers to have a natural sweetener.
- Processed Stevia products, and
- Ready to eat products containing Stevia.

5.2.5. Objective Five:

The last objective of this study was to compare the results of the study to the literature. This was accomplished and is presented in Chapter Four of this thesis.

5.3. Implications of the findings

The researcher identified four main implications of the findings of this research. These implications are listed below:

5.3.1. Stevia and Stevia-based products commercial use:

Stevia and Stevia-processed products may be commercially used in New Zealand as:

- A sweetener and as an ingredient for the food industry;
- Commercial production; and
- For house hold use and growing in home gardens.

For New Zealand consumers, the study may open the way for the potential introduction of an alternative sweetener, Stevia. This naturally occurring sweetener, with no calories, could be the replacement for sugar and artificial sweeteners, especially for those at-risk groups such as diabetics and Maori (because of the high rates of diabetes and obesity present amongst them) and people who have health problems such as: obesity, hypertension, cardiovascular deficiency, hyperglycaemia, candidiasis, and so on. Stevia is believed to help those consumers who desire a healthier life and a greater sense of wellbeing that might be achieved through a reduction in sugar intake. The four groups (of potential consumers) that were analysed in this research had a positive reaction toward the introduction of Stevia.

5.3.2. Stevia and Stevia-based products implications for Health and Research Areas:

The research findings have implications for health and research areas. In the health area it is estimated that diabetes related problems account for between 5% and 10% of a nation's health budget. The human and economic costs of diabetes could be significantly reduced by investing in prevention (International Diabetes Federation 2003). Stevia could be part of a prevention program that could result in a decrease in diabetes Type II. In addition, the use of Stevia could lead to a reduction in the occurrence of obesity and other diseases commonly associated with high levels of sugar consumption. In the research area, there is no previous research done on Stevia in New Zealand.

5.3.3. Stevia and Stevia based potential implications for New Zealand food industry:

The results of this research could have implications for New Zealand's food businesses because Stevia may become a base for a range of new products. The addition of Stevia-processed products would cover a market segment of customers who want to replace or combine their current sweeteners with Stevia.

The potential implications this study could have on food industries, can be divided in two different groups:

The first group are the food industries that could use Stevia-based products as ingredients for the preparation of ready-made products. Participants of all four focus groups were asked to give some ideas or suggestions in what kind of ready-made products they would like to have Stevia as a sweetener; they responded with several kind of products, including dairy products, baked goods (cookies, biscuits, cakes, etc.), sweets (lollies, candies, preserves, etc.), drinks (soft drinks, juices, and others) and other products such as: jam, sauces, cereals, toothpastes, skin lotions.

The second group that may find the potential market for Stevia in New Zealand interesting as a potential business opportunity, is investors who want to open a Stevia extraction industry or an industry were to produce the different Stevia-based products (with imported raw material).

5.3.4. Stevia as a potential crop for growers:

It could be possible that this study has some implication for potential Stevia growers. The focus group sessions had a section where participants could express their interest in growing, but only general and basic information on this issue was covered.

5.3.5. Recommendations on Stevia PDP for New Zealand food

industries:

This research comprises a different approach of what is usually expected from a Product Development Process:

1. The first difference is that the suggested development of a product is not of a NEW product, but of a product that already has been developed and is used in other markets, although not in the New Zealand market. Therefore, a possible description of a PDP for Stevia and Stevia-based products in New Zealand was presented. To do this, the Paraguayan Stevia experience (which does not have a defined PDP) was considered and used as a framework. The decision for doing this helped the researcher to identify some of the risks that could happen if no PDP is used (time, effort and financial waste; loss of trust by external and internal buyers, failure of programs and plans, etc.).
2. The second difference from a conventional PDP is that some of the stages or steps considered in the traditional approaches were not included in this specific PDP (Project set-up; Product concept generation; Product design; etc.).

The following recommendations on conducting a PDP were developed:

➤ **Pre-development phase:**

1. The opportunity or needs identification, which was partially done in this research with the four focus groups. However, more research in this area may be needed. If so, other focus groups can be organised, or other techniques can be applied;
2. The product idea generation or screening, decision about the product (processed form, ready-made products, etc.); and
3. The business analysis.

➤ **Development phase**

For this stage a specific management structure was recommended (especially from the R&D, Marketing and Financial Departments) and employees. The recommended management structure should cover the following activities:

- Product Development and/or use testing;
- Field-testing and/or market testing; and
- Marketing Development.

➤ **Commercial phase**

This phase would involve mainly steps such as:

- Commercialisation and
- Post launch review.

When a product is undergoing development or has been developed and is ready to be launched, it is important to consider some key components of success (according to a Hungarian SAPPHO study – Rothwell, 1976):

- Market need satisfaction,
- Effective internal communication,
- Efficient development,
- Strong marketing orientation, and
- The role of key individuals.

The strategic plan should consider the competition carefully as well as other threats such as: blurring of market boundaries, escalating customer diversity and, as stated previously the increasing global competitive threats (Cravens et al., 2000).

5.4. Evaluation of the methodology

In this section the methodology that was used to write this study is evaluated. The researcher identifies some of the areas of this research that could be strengthened.

5.4.1. Case Selection

The case selection in this study was done in a semi-random way. Two target groups (diabetics and Maori) were the primary groups, and the researcher added a ‘general public group’ and a ‘herb experts group’. This was done in order to have a broader sample of opinions and reactions of selected groups of consumers about Stevia.

5.4.2. Data Collection

The methodology used for this research was based on obtaining data in a mixed form. Both qualitative and quantitative data collection approaches were used. This project focused mainly on qualitative consumer research, which, according to Chambers and Smith (1991) can be used to investigate a wide range of issues and obtain detailed information about consumer attitudes, opinions, perceptions, behaviours, habits, and practices. For this study focus groups were used in addition to semi-structured interviews, questionnaires and secondary data.

When case studies are used as a research strategy, researchers need to be aware of the importance of a comprehensive literature review before initiating collection and analysis of data (Gray, 2001). The researcher used the literature review mainly to guide the research in a specific direction, to find out how other authors approached similar studies, and to corroborate information from other sources. Some areas of interest for this study were not found in the literature, for example: Stevia PDP experiences in other countries, consumers' opinions and reactions towards food and beverages prepared with Stevia-based products.

The two different interviews used in this study were: focus groups and one-on-one interviews. For both were semi-structured interviews. This technique was effective. The tape recording and transcription of interviews were essential. Respondents' verification of the interview summaries was not done. This inaction may be a negative point since it was then difficult to identify areas where the data had been misinterpreted or to obtain clarification of meaning and terms.

The focus group method was considered less formal data collection process than semi-structured interviews. Although the information collected during the sessions was enough to perform the analysis, having the focus groups sessions conducted by an expert facilitator would have increased the reliability of the data collected during the sessions.

5.5. Key Findings

Four key findings have been made in this research, they are:

- There is a potential market for Stevia as a sweetener in New Zealand;
- An obstacle to the broader use of Stevia in New Zealand is that it may only be in plant form (according to the FSANZ). Stevia-based products are prevented from use as sweeteners in New Zealand by regulation of the FSANZ;
- Participants of the focus groups prefer the powder form to all Stevia types available. The main reasons for their preferences are that the powder form is a dry ingredient like sugar, which makes it easier to use and to measure; and
- Food industries could use Stevia-based products as ingredients for the preparation of ready to eat and/or drink products.

5.6. Future Research and Recommendations

Four sections were identified as needing future research in New Zealand:

- Thesis-related research;
- Safety and medicinal research;
- Industrial research; and
- Agronomical research.

People who could benefit from such research are:

- postgraduate students (as a research project);
- companies (as a business opportunity);
- industries (for potential products); and
- Government (as a potential sweetener that could help reduce obesity and diabetes rates with a consequent budget reduction to treat these health problems), etc.

5.6.1. Thesis - related research:

From this study a range of future research areas have been identified in relation to the use of Stevia as an alternative sweetener in New Zealand.

In relation to finding out about Stevia's acceptance as an alternative sweetener in New Zealand, an important area for future research would be market research⁵. As this research only analysed four focus groups of four different market segments (general public, herb experts, diabetics and Maori) from one region of New Zealand (Manawatu), a broader and more in-depth study is recommended. Additional focus group sessions in other regions, and perhaps other market segments, could contribute to a better understanding of consumers' attitudes and opinions towards Stevia.

Quantitative research methods that comprise a wider sampling analysis, utilising surveys, more professional taste tests, etc. may present another research opportunity. Such methods may include statistical analysis and cover a wider range of consumers in order to make generalisations. More in depth quantitative methods will be potentially useful to generalise and predict the demand in New Zealand for these products.

Research on introducing Stevia and Stevia-based products to diabetics and Maori groups should be continued. These two target groups could get more benefits from Stevia than other groups interviewed.

One of the Product Development stages is the Business Analysis. In this respect, to decide if a product (in this case Stevia) is worth introducing into a certain market (New Zealand) a profitability analysis has to be done. Therefore, it is recommended that further research analyses be done on the financial and economical feasibility of introducing Stevia into New Zealand (as a crop, as an industry, as an ingredient for other industries, etc.).

The information collected was analysed to make conclusions about the willingness of participants to replace their current sweeteners with Stevia. Further research could analyse the potential for wider use of Stevia products in the range of food products in New Zealand.

⁵ The data collection and analysis of information about consumers, niche markets, and the effectiveness of marketing programs.

Stevia is a well-known sweetener and flavour enhancer in many industrial countries such as: Japan, Germany, Israel and China. Therefore, it is suggested that an investigation into the process of how Stevia was successfully introduced in these countries be undertaken. Such research could be useful for the implementation of Stevia's development process in New Zealand.

Some additional minor research recommendations are:

- 1) To prepare a specific New Zealand table of conversion for Stevia in comparison with other sweeteners such as sugar and artificial sweeteners;
- 2) When food and beverages are prepared (for tasting matters) for New Zealanders, use local recipes; and
- 3) When taste tests and/or focus groups are used, have the same recipes (prepared with Stevia) prepared with other sweeteners as well. This permits a direct comparison.

5.6.2. Safety and medicinal research:

Interested parties for additional research include: Diabetes Society of New Zealand; Medical Universities (New Zealand); Ministry of Health (New Zealand); Medical Research Institutions. Research topics in this area include:

- Medical research on issues concerning New Zealand's society or authorities;
- Safety tests of Stevia, Stevia-based products and Stevia containing products;
- Medical research on the use of Stevia for Diabetes (especially Diabetes Type II);
- Medical research on the use of Stevia for the treatment of obesity;
- Medical research on the use of Stevia for the treatment of high blood pressure;
- Research into the social impact of a reduction in Type II diabetes, obesity and high blood pressure in the Maori / Pacific Island community;
- Economic impact of a decrease in diabetes and obesity rates in New Zealand.

5.6.3. Industrial research:

People that might be interested in doing research on Stevia in an industrial perspective include: Postgraduate students of food technology, engineering, food processing, New

Product Development teams, Food Research Institutes, Food Companies and ingredient companies. Potential research areas for industrial research include:

- Identification of appropriate processing procedures that will produce a natural product with reliable quality;
- Identification of the required technology for industrialising Stevia leaves;
- Identification of the required technology for extracting Stevioside and Rebaudiosides;
- Development or identification of the required technology to produce good quality Stevioside and Rebaudiosides;
- Development or identification of the required technology for producing Stevia-based products (powder, liquid extract, tablets, tea-bags, etc.);
- New food product development using Stevia.

5.6.4. Agronomical research in New Zealand:

Some of the possible people or institutions that might be interested in conducting agronomical research on Stevia include post-graduate students of science, natural resources or horticulture, agronomical research Institutes and potential Stevia growers.

Since there is no previous research in New Zealand on the agronomical issues of Stevia, there are several potential areas identified for further research:

- Feasibility of growing Stevia in New Zealand (agronomical and economic);
- Identification of varieties that can be established from seed in New Zealand;
- Selection of the Stevia variety most suitable for New Zealand's environment;
- Development of efficient seed and/or plant production and handling procedures;
- Identification of the length of growing season;
- Identification of the number and timing of harvests during a growing season;
- Development of harvesting and drying procedures essential for efficient mechanisation.

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APPENDIX 1

Focus Group session details

1. The introduction phase included these topics:

- Stevia plant (other names, family, genus, specie, related to...);
- Stevia's origin;
- History;
- Production and consumption;
- Advantages and properties;
- Stevia products (types, forms);
- Legal issues;
- Description of the thesis; and
- The purpose of the focus group discussion.

2. List of questions to find answers for (N questions).

1. Existence of Stevia

- 1.1. Have you heard/read about Stevia before? Where? When? What?
- 1.2. Did it catch your attention, why and what?
- 1.3. Do you know about Stevia's health benefits and advantages in comparison to other sweeteners?

2. If available would you replace your current sweetener with Stevia?

- 2.1. Would you like to grow it yourself or would you prefer to buy it in a commercial form?
- 2.2. What form/presentation would you prefer to buy if buying finished products: powder, syrup, concentrate, bags (like tea bags)?
- 2.3. What things do you consider important when buying a sweetener: price, origin, form, presentation?

Taste here

3. Likes about Stevia?

- 3.1. Now that you have tasted Stevia, what things do you like about Stevia?
- 3.2. What advantages does Stevia have in comparison with your current sweeteners?
- 3.3. Would you replace your current sweetener with Stevia? Why/ why not?

4. Dislikes about Stevia?

- 4.1. Was there an after taste or taste you do not like?
- 4.2. Is it too sweet or not sweet enough?
- 4.3. Comparing with your current sweeteners, what disadvantages does Stevia have?

5. Preferences in form of sweeteners?

- 5.1. What are advantages and disadvantages of using the powder?
- 5.2. What are advantages and disadvantages of using the liquid extract?
- 5.3. What are advantages and disadvantages of dry leaf powder?
- 5.4. What are advantages and disadvantages of packs?

6. Ready-made products prepared with Stevia

- 6.1. What products do you suggest would be good if containing Stevia?
- 6.2. What ready-made products would you buy if containing Stevia?

APPENDIX 2

Questionnaire for the Focus Group participants:

Gender Female Male

Age group <18 19-25 26-35 36-50 >50

Ethnic group

Caucasian Samoan Chinese Arabic

NZ Maori Tongan Indian Latin

I do not wish to answer this question

Other _____

Do you like sweetening?

Extremely Very strongly Strongly Moderately Indifferent No

Other _____

Do you use sweetening in your beverages?

Always Often Sometimes Never

Are you using sugar substitutes? (E.g. honey, Equal, Saccharin, Nutrasweet)

Always Often Sometimes Never

What is the main source of sweetening in your diet?

Food Beverages Candies Honey Fruit Others

Are you visiting health shops?

Often Sometimes Never

If you have any comments about this questionnaire, could you please share with us?

What kind of person do you consider yourself?

Are you a person conscious of health concerns? Yes No

Do you worry about your weight? Yes No

What is your Sweetener consumption?

What kind of sweeteners do you use in beverages?

What kind of sweeteners do you use in cooking and/or baking?

What is your average monthly consumption of the most commonly used sweetener?

What do you like and what do you dislike about your current sweetener?

Do your current sweeteners have an aftertaste? Yes No

Where do you usually buy your sweeteners?

Do you usually go to health or herb shops? Yes No

Do you usually buy your sweeteners in supermarkets? Yes No

What is your opinion about Stevia?

Did you like the snacks you tried ? Yes No

Did you like the Stevia on the beverage you had? Yes No

Did you feel an aftertaste? Yes No

Would you sweeten your foods and beverages with Stevia? Yes No

THANK YOU VERY MUCH FOR YOUR TIME, SUGGESTIONS, AND OPINIONS!!! WE REALLY APPRECIATE IT!!!

APPENDIX 3

Definition Table 1: General Public

Table A.1. Definition table of the General Public focus group

N/A = No answers or discussion

Category	Location	Definition	Data bits- Evidence	Line number
Potential use of Stevia in New Zealand				
Sensory Evaluation				
1. Sensory Evaluation	Sensory evaluation	To examine and judge carefully; the transmission of impulses from sense organs to nerve centres. Especially the taste and touching senses.	From the context	
1.1. Sweetness	Sensory evaluation, Sweetness	The property of having a pleasantly sweet taste. The quality or state of being sweet (in any sense of the adjective); gratefulness to the taste or to the smell; agreeableness.	See points 1.1.1. and 1.1.2. This category was created to classify the answers.	
1.1.1. Positive responses	Sensory evaluation, Sweetness, Positive responses	Characterised by or displaying certainty, acceptance, or affirmation answers.	"It is natural and sweet" "Very sweet." "Yea a strong sweetness" "The strength and the character that is amazing." "Its very sweet." "Sweet enough." "I put 1 and my coffee was extra sweet." "... for me ½ a teaspoon would be more than enough."	23 94 228 229 270 293 293 292-293
1.1.2. Negative response	Sensory evaluation, Sweetness, Negative response	Expressing, containing, or consisting of a negation, refusal, or denial answer.	"That would be too sweet for me."	76
1.2. Flavour	Sensory evaluation, Flavour	That quality of anything which affects the taste; that quality which gratifies the palate	"How do you find it? Are you liking it until now?"	90
1.2.1. Positive responses	Sensory evaluation, Flavour, Positive responses	Idem 1.1.1..	"Hmm, good" "Very nice." "Delicious" "These cookies are good." "Hmmm, both." "I had a whole pack and didn't get to taste anything abnormal." "the carrot cake was nice" "Yea, its flavour is nice," "Honestly I don't think there is much difference." "I think it's really nice."	91 93 95 111 116 232 – 233 248 255 270 277

			“This is nice now... ” “I’ll like to take 2 and still feel the sweetness and citrus.”	278 291
1.2.2. Negative responses	Sensory evaluation, Flavour, Negative resp.	Idem 1.1.2.	“Drink is tasteless... ” “It is feeling neutral.” “... it is pretty neutral. I just put half more so it is strong... ”	259 280 282
1.3. Aftertaste	Sensory evaluation, Aftertaste	A taste persisting in the mouth after the substance that caused it is no longer present.	“Is there an after taste?” “The after taste, was it really strong with the coffee?”	92 240-241
1.3.1. Positive responses	Sensory evaluation, Aftertaste, Positive responses	Idem 1.1.1..	“... orange and lemonade no aftertaste.” “I didn’t get to feel an aftertaste.” “I noticed a taste, an aftertaste, but it was not bad... ” “... just a different.” “No, I don’t think so.” (feel aftertaste with coffee)	226 232 235 237 242
1.3.2. Negative responses	Sensory evaluation, Aftertaste, Negative responses	Idem 1.1.2.	“Funny aftertaste.” “the butter cookies had a slight after taste”	96 257
1.4. Quantity	Sensory evaluation, Quantity	A specified or indefinite number or amount	“Its just the matter of knowing how much to use.” “it’s difficult the first time, you don’t know the right measure to use. “ “Yea, you have to know the conversion/ the ration when comparing with sugar, how much to put.” “It’s quite good because two drops make up the same amount of sugar, I use.” “... it pays back... usually people don’t see that they need less of it”	270-271 272-273 274-275 321-322 385
1.5. Texture	Sensory evaluation, Texture	The feel of a surface	“Leaves nice texture” “... they are really wet ... they really are not going to stay in my hand, whereas that one I can hold it and eat it properly.” “it is just the texture, it is strange.” “But does it change the texture of the baking?”	226-227 251-253 255 316
1.6. Appearance	N/A			
Market Issues				
2. Market issues	Market Issues	Something proceeding from the world of commercial activity where goods and services are bought and sold.	From the context	
2.1. Information	Market Issues, Information	Knowledge derived from study, experience, or instruction.	From the context	
2.1.1. General information	Market Issues, Information, General information	Data and facts about Stevia in general terms.	“... but I would probably need some more information, reasons.” “where it says how to use it. ... what about cooking with leaves. ... how would you do that. You’ve got the plant, can you take the leaves. How do you refine the plant to use it? What are the requirements?” “... I want to ask you could you use	177 179-182 163

			Stevia for baking? Is it heat stable? "	
2.2. Marketing Issues	Market Issues, Marketing issues	The commercial functions involved in transferring goods from producer to consumer.	From the context	
2.2.1. Price	Market Issues, Marketing issues, Price	The amount as of money or goods, asked for or given in exchange for something else	"I think the price." "Yea, it's hard to say because I use it a lot, but it's the price I guess." "for a commercial baking or things like that then probably it would be the price" "Wait. But who doesn't look at the price?" "I look at different things, I have found the different brands, you may or may not like that particular brand" "And how expensive are the products?"	333 334 337-338 343 375
2.2.2. Product	Market Issues, Marketing issues, Product	Something produced by human or mechanical effort or by a natural process	"if it was just like me, then it would depend on the product, that one was good so I'll take it again, that one lasted longer so, it is worth, and things like that would be meaningful for me when buying a product for me" "for my own use then the product, quality... " "I look at different things, ... different brands, you may or may not like that particular brand"	334-337 338-339 345-346
2.2.3. Place	Market Issues, Marketing issues, Place	A channel of distribution comprises a set of institutions which perform all of the activities utilised to move a product and its title from production to consumption.	"Can you find it normally in health shops?" "I did not see any promotion." "So we have to wait until it gets more common?" "... but how is it, it is still not here?" "... but as I know they are not available at the moment are they?" "I know in some place down south they were offering breads and cookies ... in Auckland there must be a huge demand for all this stuff"	186 188 196 198 402 408-409
2.3. New Products	Market Issues, New products	Not previously experienced or encountered; novel or unfamiliar product.	"So most of you suggested that ready-made products made out of Stevia could be an option too for you, like cookies, juices what else?"	400-401
2.3.1. Drinks	Market Issues, New products, Drinks	To take into the mouth and swallow (a liquid).	"I could put it into my cordial," "I could prepare my lemonade with it, and I thought that is great... " "be the first person who will drink it in diet soft drinks" "... advertised juice like diet lemonade, orange juices, pure orange juice, and I like them and you can use half and half, the same with blackcurrant and cranberry" "tea or coffee and I noticed that people drink 3 to 4 cups of tea ... "	17 18-19 26 395-396 398-399
2.3.2. Bakery	Market Issues, New products, Bakery	Products such as bread, cake, and pastries are baked or sold	"I know in some place down south they were offering breads and cookies"	408
2.3.3. Sweets	Market Issues, New products, Sweets	Foods, such as candy, pastries, puddings, or preserves	"... using Stevia instead of sugar in things like that, lollies, chocolates, or things like that"	426-427

2.3.4. Dairy products	N/A			
2.3.5. Others	Market Issues, New products, Others	Different from that or those implied or specified before.	“like stewed rhubarb ... I love that stuff ... like sauces, rhubarb sauce” “Stevia could be good for cereals.” “That’s actually why I bought the Stevia plant because of the rhubarb”	66-68 135 171-172
2.4. Competition	Market Issues, Competition	One that competes with another; a rival	From the context	
2.4.1. Sugar	Market Issues, Competition, Sugar	A sweet crystalline or powdered substance, white when pure, consisting of sucrose obtained mainly from sugar cane and sugar beets and used in many foods, drinks, and medicines to improve their taste.	“She uses normal sugar for cookies and sweets, but she doesn’t do it a lot, ... “ “we don’t use sweeteners, just normal sugar.” “When we bake we use brown sugar and castor sugar and icing sugar otherwise but we don’t use any of those. We don’t have many sweet things. We don’t use any artificial sweeteners.” “We probably mostly use sugar” “I use sugar for my drinks ... I still add it to some of my cooking. And in my baking I also use some sugar.” “I use lots of normal sugar, castor sugar, brown sugar for baking, but in my drinks normally just normal sugar”	129-130 133 137-139 145 148-149 151-152
2.4.2. Artificial sweeteners	Market Issues, Competition, Artificial sweeteners	A sweet substance added to food or drinks to improve its flavour.	“So what do they use for sweetening the soft diet drinks? I think Nutrasweet-aspartame.” “... because of market pressure and the success of diet coke made by good advertisement. So now artificial sweeteners have taken place you can buy them in whatever food or drink, which you couldn’t do 10 years ago” “I find Nutrasweet a tragic thing because you cannot cook with it, it breaks down with heat ... And the finished products... I don’t think they are safe” “one that was before Nutrasweet is Saccharin and the other was cyclamate and they were shown to cause cancer. ... people don’t know about all that” “We don’t use any artificial sweeteners.” “We use Equal and sometimes sugar. When I’m baking Equal powder.” “now and then I’ll use Sucaryl in drinks. And a little bit in cooking” “And no artificial sweeteners? No, no at all.”	38-39 48-50 54-55 57-59 139 141 145-146 153-154
2.4.3. Others	N/A			
Health and Research issues				
3. Health and Research Issues	Health and Research Issues	Things related to the soundness of body or mind; freedom from disease or abnormality; and about scholarly or scientific investigation or inquiry.	From the context	
3.1. Safety	N/A			
3.2. Health	Health and Research Issues, Health	Soundness of body or mind; freedom from disease or abnormality.	“... the sweeteners have been targeted from the medical view not the lifestyle so much.”	416-417

3.2.1. Diabetics	Health and Research Issues, Diabetics	A person who has diabetes.	"What is the diabetics attitude towards it? Do they recommend it at all? Do they know it?"	413-414
Potential	N/A			
Market segment	Health and Research Issues, Diabetics, Market segment	One of several pieces or parts that fit with others to constitute a whole of the world of commercial activity where goods and services are bought and sold.	"In the 60's and 70's it became something else for diabetics but in these days it's probably a market I think"	418-419
Alternative to Artificial Sweeteners	Health and Research Issues, Diabetics, Alternative to artificial sweeteners	The course of action or the thing (Stevia) offered in place of artificial sweeteners	"... it was Saccharin or something like that, purely for diabetics" "What I know is that the only sweeteners diabetics can take are artificial isn't it? The only sweeteners they've got are artificial. Bad isn't it." "but they were tablets and she said they have side effects that take longer to appear, and they could now feel some of them." "I have a 7 years old and I don't want to expose him, because I read something that children should not be given Nutrasweet because it puts back the growth,"	417-418 440-441 158-159 168-170
Natural	Health and Research Issues, Diabetics, Natural	Present in or produced by nature.	"A natural sweetener would be good for them."	443
3.2.2. Obesity	N/A			
3.2.3. Replaces sugar intake	Health and Research Issues, Health, Replaces sugar intake	To use Stevia instead of sugar	"without adding a lot of sugar" "I'd be very keen on sugar substitutes. Because I know it has a lot of sugar, and I really drink litres of that." "I know sugar isn't good for us,"	17-18 27-28 148
3.2.4. Is good for you	N/A			
3.2.5. Is good for teeth	Health and Research Issues, Health, Is good for teeth	Stevia is said not to damage teeth	"Exactly and kids can have it with no risk for their teeth."	24
3.2.6. Has no calories	Health and Research Issues, Health, Has no calories	Stevia is not absorbed in the body	"No calories, sweet."	240
3.3. Research	N/A			
Convenience				
4. Convenience	Convenience	The quality of being suitable to one's comfort, purposes, or needs.	From the context	
4.1. Growing	Convenience, Growing	To allow (something) to develop or increase by a	"Does it grow well in New Zealand?" "If you want to grow it,"	200

		natural process.		360
4.1.1. Propagation	Convenience, Growing, Propagation	The process of spreading to a larger area or greater number; dissemination.	"You may even propagate it with cuttings."	204
4.1.2. Care	Convenience, Growing, Care	the work of caring for or attending to someone or something.	"If you take good care, it should. It doesn't like frost It doesn't have many problems, it looks sometime it dyed but then it comes out again." "they shouldn't get dry because they will die. They like watering everyday. When it is hot you can keep them outside, but they have to be moist, not too much water because they don't like that either." "What would you feed it? <i>Just water every day and of course if you put fertilisers it will be better.</i> "	201-203 361-363 366-367
4.1.3. Containers	Convenience, Growing, Containers	A receptacle, such as a carton, can, or jar, in which material or a plant is held, carried or grown	"So you could grow it in a container, (inaudible) grow it in a container where there's no frost?"	208-209
4.1.4. Size	Convenience, Growing, Size	The physical dimensions, proportions, magnitude, or extent of a plant.	"Does it grow into a big bush? <i>About seventy-five cms and 40 to 50 cm wide.</i> "	211-212
4.2. Application	Convenience, Application	The act of putting something to a special use or purpose.	"And do you know if children can take it too?"	390
4.2.1. Plant	Convenience, Application, Plant	A plant having no permanent woody stem; an herb.	"What about if you want to use it, you pick the leaves directly up?" "What did you say about how to use the leaves?"	364 450
4.2.1.1. Cooking	N/A			
4.2.1.2. Lotion	Convenience, Application, Plant, Skin and wounds	A liquid preparation for bathing the skin, or an injured or diseased part, either for a medicinal purpose, or for improving its appearance.	<i>You can prepare your own syrup out of it and apply it directly on your skin to make it softer or on your wounds to heal them faster.</i> "	451-452
4.2.2. Processed products	Convenience, Application, Processed products	A series of operations performed in the making or treatment of a product.	"I would be interested in baking with it."	387
4.3. Form	Convenience, Form	The shape and structure of an object.	<i>"So at looking at all the forms, what form would you buy it in if available for you. What would you prefer and why?"</i>	301-302
4.3.1. Powder	Convenience, Form, Powder	A substance consisting of ground, pulverised, or otherwise finely dispersed solid particles.	"... because I like to bake a lot, and cook, I would prefer the powder, it is more like sugar." "I rather use it in the powder form."	303-304 326
4.3.2. Liquid extract	Convenience, Form, Liquid extract	A concentrated preparation of the essential constituents of a food, flavouring, or other substance; a concentrate	"But I suppose that for drinks I would use the liquid extract." "the liquid extract I wouldn't like for baking, I don't know I have never tried but I don't like the idea of using liquid for baking, it is a custom,"	304 306-307

		flowing freely like water; fluid; not solid.	“It’s quite good because two drops make up the same amount of sugar, I use.” “Is the liquid extract strong?”	321-322 444
4.3.3. Plant	Convenience, Form, Plant	Idem 4.2.1.	“I would prefer the plant itself.” “the plant because it is natural, healthier and cheaper.” “And how do you dry the leaves?”	330 348-349 454
4.3.4. Others	Convenience, Form, Others	Idem 2.3.4.	“I really would use it for everything like that... try them all.” <i>“For everything, for beverage, cooking, baking?”</i> I probably would, yea I think so.” “I like both.”	309 311-312 327

APPENDIX 4

Definition Table 2: Herb experts

Table A.2. Definition table of the Herb Experts focus group

N/A = No answers or discussion

Category	Location	Definition	Data bits- Evidence	Line number
Potential use of Stevia in New Zealand				
Sensory Evaluation				
1. Sensory Evaluation	Sensory evaluation	To examine and judge carefully; the transmission of impulses from sense organs to nerve centres. Especially the taste and touching senses.	From the context	
1.1. Sweetness	Sensory evaluation, Sweetness	The property of having a pleasantly sweet taste. The quality or state of being sweet (in any sense of the adjective); gratefulness to the taste or to the smell; agreeableness.	"Marvellous it is."	316
1.1.1. Positive responses	Sensory evaluation, Sweetness, Positive responses	Characterised by or displaying certainty, acceptance, or affirmation answers.	"These products are a lot sweeter." "We don't even need all that." "Really strong" "I knew it was very sweet." "And you are finding that quite sweet? Definitely yes, very." "The second cup it's just as sweet as the first" "I had five cups of tea and two leaves and it still tastes like the first one." "And on the third one I actually took a piece of the leaf and chewed it, and it's very sweet."	33 34 36 140 177-178 202 713 719-720
1.1.2. Negative response	Sensory evaluation, Sweetness, Negative response	Expressing, containing, or consisting of a negation, refusal, or denial answer.	"It's sweet, but it's not that sweet."	199
1.2. Flavour	Sensory evaluation, Flavour	That quality of anything which affects the taste; that quality which gratifies the palate	"It's the taste." "Taste. I don't go for the colour, it's the actual flavour and the flavour of that I found nice,"	172 173
1.2.1. Positive responses	Sensory evaluation, Flavour, Positive responses	Idem 1.1.1.	"I think that the lemon drink needs more than one packet of this because this is very refreshing, very nice." "This has got much more flavour to it" "I think if you didn't know that that orange was made with Stevia you wouldn't question it." "... it tastes good." "I think it might be lovely with Stevia." "like the good taste of the – the taste like	126-127 173-174 201-202 480-481 506 509

			<p>sugar”</p> <p>“I like the taste and texture, but I cant tell you why. I like them. It’s just that”</p> <p>“I mean I could serve those up to my kids and they would eat that quite happily and think it’s sugar.”</p> <p>“They would think it’s normal. They just think its food .”</p> <p>“And I m quite sure I serve it up there as an apple pie and they would accept it. I think that it would be a pretty good connoisseur that would pick the difference... ”</p> <p>“Yes the orange was very nice. “</p> <p>“Yes I think so too, very pleasant.”</p> <p><i>“Refreshing taste for drinks ”</i></p> <p><i>“has more flavour,”</i></p>	<p>538</p> <p>558</p> <p>577-578</p> <p>580-581</p> <p>582-583</p> <p>651</p> <p>652</p> <p>654-655</p> <p>655</p>
1.2.2. Negative responses	Sensory evaluation, Flavour, Negative responses	Idem 1.1.2.	<p>“It has a strong taste.”</p> <p>“and the flavour of that I found nice”</p> <p>“I mean I like real coffee and it comes in a – no flavour whatsoever. It’s basically tasteless”</p>	<p>25</p> <p>173-174</p> <p>510-511</p>
1.3. Aftertaste	Sensory evaluation, Aftertaste	A taste persisting in the mouth after the substance that caused it is no longer present.	<i>“And I think also if you put a little too much, then you feel it more, but when its like the right amount then you almost dont notice anything.”</i>	644-645
1.3.1. Positive responses	Sensory evaluation, Aftertaste, Positive responses	Idem 1.1.1.	<p>“I don’t think it had that... After taste. No.”</p> <p>“It’s pleasant though. It’s pleasant isn’t it?”</p> <p>“I found it quite – the orange there was no aftertaste – it was just like an ordinary.”</p>	<p>472-474</p> <p>545</p> <p>650</p>
1.3.2. Negative responses	Sensory evaluation, Aftertaste, Negative responses	Idem 1.1.2.	<p>“To me it tastes like it has a slight after taste. Would that be the Stevia? “</p> <p>“Not unpleasant, but ... ”</p> <p>“I feel now after tasting, I had a definite after taste in my mouth sort of thing that leaves a taste.”</p> <p>“Well I thought the lemon juice and the carrot had a more instant after taste. Now I tend to feel that it’s a combination of other things – the amount. Not unpleasant, but just quite.”</p> <p>“what are the aftertastes because I definitely quite find an unpleasant aftertaste.“</p> <p>“I just wondered whether there is like the fillers that they use or whether it’s actually you know the plant?”</p> <p>“I felt that with the lemon drink it was very much an after taste and I watered down and it disappeared.”</p> <p>“I found the after taste less in drinks.”</p>	<p>80</p> <p>82</p> <p>543-544</p> <p>547-549</p> <p>630-631</p> <p>633-634</p> <p>647-648</p> <p>649</p>
1.4. Quantity	Sensory evaluation, Quantity	A specified or indefinite number or amount	<p>“So how did you work out the quantities of – I mean that’s obviously a lot for that experiment”</p> <p>“You just couldn’t make the quantity.”</p> <p>“It’s says here for that one there, if you use two teaspoons of sugar you use just one packet of this. So you halve. So you have half of one.”</p>	<p>54-55</p> <p>420</p> <p>459-461</p>

			<i>"need small quantities"</i>	654
1.5. Texture	Sensory evaluation, Texture	The feel of a surface	<p>"See the texture is quite dry. Is it because of the Stevia or just the recipe?"</p> <p>"interesting the texture"</p> <p>"some of you liked the texture, but some didn't like it very much"</p> <p>"It's really difficult though as far the texture is concerned, because we don't know what it would be like with sugar to compare it."</p> <p>"I probably would do a cookie that would end up sort of like that anyway."</p> <p>"The texture is very very similar"</p> <p>"I like the taste and texture, but I can't tell you why. I like them. It's just that"</p> <p>"I love the texture of the carrot cake, which reminded me of pumpkin pie. Me too.</p> <p>And of course I love the roughness of the oat cookies. I think it's just a personal thing perhaps."</p> <p>"The texture is nice, I mean it depends."</p> <p>"I think the apple pie is quite dry"</p> <p>"Where there is that recipe that makes it a bit dry or if it is the Stevia. I don't know"</p>	219 539 539-540 550-551 554 556 558 560-563 568 585 587-588
1.6. Appearance	Sensory evaluation, Appearance	Outward or visible aspect of a person or thing.	<p>"... but the colour is a bit funny"</p> <p>"The colour too is because of variety. It shouldn't change"</p> <p>"Change the colour. You know it was really weak, and look at it. But it's not Stevioside. What is in there? It's the filler"</p> <p>"I was just a surprise to see the black."</p> <p>"And the green colour. You don't like the green colour very much or the green rest of the leaves for example in the food or drinks."</p> <p>"No, doesn't bother me. Personally it wouldn't worry me, but I think for others, for more conventional people it could be an off put for children who wouldn't eat anything that was different."</p>	202-203 343-344 485-488 504 661-663 664-666
Market Issues				
2. Market issues	Market Issues	Something proceeding from the world of commercial activity where goods and services are bought and sold.		
2.1. Information	Market Issues, Information	Knowledge derived from study, experience, or instruction.	"Stevia but I don't think I have enough information"	114-115
2.1.1. General information	Market Issues, Information, General information	Data and facts about Stevia in general terms.	<p>"But the liquids are fine how do they extract them?"</p> <p>"Is it a complicated process to extract it do you know?"</p> <p>"It hasn't been made public?"</p> <p>"For children?"</p> <p>"It would be interesting to see how it reacted with other flavours. When</p>	286 291 326 340 768

			combined.”	
2.1.1.1. Fillers	Market Issues, Information, General information	Something added to augment weight or size or fill space.	“What is in there? It’s the filler” “But if you have a look, what is the filler?” Yea, but it depends on what they’ve used as the filler in this.” “Filler, it’s filler FOS. And if they used that FOS in that” “What I’m trying to tell you it’s probably the same fillers here as in other sweeteners.”	487-488 492-493 494-495 501-502
2.2. Marketing Issues	Market Issues, Marketing issues	The commercial functions involved in transferring goods from producer to consumer.	“ <i>When you buy your sweeteners what things do you consider when buying them,</i> ”	296-297
2.2.1. Price	Market Issues, Marketing issues, Price	The amount as of money or goods, asked for or given in exchange for something else	“Because I bake a lot for my family and things like that kind, so I always buy big bulk” “ <i>And do you also look at the price then?</i> ” “No, it’s not really a matter of the price if I need to replace. Price doesn’t matter.” “So I bounce between quality and the cost.” “In my case price wouldn’t come into it.”	298-299 304 305 395-396 693
2.2.2. Product	Market Issues, Marketing issues, Product	Something produced by human or mechanical effort or by a natural process	“My only concern would be if they had put lactose in it.” “Then also depending on what I need” “It is quite a thing. It has to make you happy.” “So I bounce between quality and the cost.” “Well if I see the products I buy because I like them or because they are good for me or I am after a healthy diet for me and my family. So probably even if it was a little more expensive than sugar it is worth it. Because it is small what you use” “... but the choice could be taste, quality.”	161 299 308 395-396 409-411 693
2.2.3. Place	Market Issues, Marketing issues, Place	A channel of distribution comprises a set of institutions which perform all of the activities utilised to move a product and its title from production to consumption.	“Did you get all of that in New Zealand, all of these products, or did you get them brought in?” “So where did you buy these things here?” “I think I saw the Stevia extract in Forever Living” “ <i>Some health shops have it, like one or two. I also saw in the shopping one of the liquid extracts.</i> ” “In one of the Plaza Shopping?” “Because we live in the country and it’s not so easy to get into town, so it’s better to make sure that it’s there all the time”	63-64 70 73 74-75 76 306-307
2.3. New Products	Market Issues, New products	Not previously experienced or encountered; novel or unfamiliar product.	“... <i>would you like to buy ready food or ready drinks for example if available also what kind of food, what kind of drinks?</i> ” “I would if I could trust that they had got	675-676 680-681

			the product in the – they had put Stevia in the product I would trust it.” “Well I don't buy very many ready-made products.”	752
2.3.1. Drinks	Market Issues, New products, Drinks	To take into the mouth and swallow (a liquid).	“All fruit drinks” “And the drinks, well I normally buy them and they are not sugar added like it consists of something like that. But if I was going to buy drinks for any kids” “... and in maybe cordial, because I make lemon cordial, or lemonade” “buy the odd bit of lemonade”	683 690-691 729 757
2.3.2. Bakery	Market Issues, New products, Bakery	Products such as bread, cake, and pastries are baked or sold	“... and biscuity sort of things.” “Yea, if I was going to buy pastry or biscuits yea, I would buy them, because I never bake them.” “Well I quite like sweetening in the biscuits.”	683 688-689 723
2.3.3. Sweets	Market Issues, New products, Sweets	Foods, such as candy, pastries, puddings, or preserves,	“I think I would try using it in preserves” “Gummy bear type things.” “Oh yes, chewing gums.” “Bubble gums”	728 776 777 778
2.3.4. Dairy products	Market Issues, New products, Dairy products	Products made out of milk or its derivatives	“. Dairy products would be interesting. Ice cream.”	723-724
2.3.5. Others	Market Issues, New products, Others	Different from that or those implied or specified before.	Have you tried to make jams? “... and the only one that I would buy is occasionally I buy the drink sachets. You know, like refresh and Raro, which must be like – well they are full of sugar. So that would be quite interesting to see it in things like that” “those sorts of things like toothpaste” “Skin products” “I'd be more interested in being able to buy a packet of this off the shelf so I can use it In my things, food” “I mean if it helps things like immune system stuff it would be good to add it to vitamin C tablets that you buy, to add Stevia to it, which acts as a sweetener”	415 754-756 760 761 764-767 770-771
2.4. Competition	Market Issues, Competition	One that competes with another; a rival	From the context	
2.4.1. Sugar	Market Issues, Competence, Sugar	A sweet crystalline or powdered substance, white when pure, consisting of sucrose obtained mainly from sugar cane and sugar beets and used in many foods, drinks, and medicines to improve their taste.	“... but when I have a cereal I like my milk personally and pour some sugar on the top.” “It depends what's there, but raw sugar I love because I love the crunch.” “I would have Stevia in instead of sugar. But I do love brown sugar.” “Then you should realise that it doesn't have the same properties then sugar. It is not suitable for caramel. So for bread it's probably not help.” “I don't normally buy sugar myself because I don't use it, only white sugar. My husband uses sugar for jams. He makes jams. Have you tried to make jams?”	168-169 171-172 208-209 243-245 413-415

2.4.2. Artificial sweeteners	Market Issues, Competence, Artificial sweeteners	A sweet substance added to food or drinks to improve its flavour.	"I think it's the same with the artificial sweeteners, you can feel an aftertaste, if you change everything, it's like everything isn't it where you go from butter to other ones, you get use to the taste after a while don't you?"	636-638
2.4.3. Others	Market Issues, Competence, Others	Idem 2.3.4.	"If I need a sweetener I normally put honey in it"	168
Health and Research issues				
3. Health and Research Issues	Health and Research Issues	Things related to the soundness of body or mind; freedom from disease or abnormality; and about scholarly or scientific investigation or inquiry.	"So you could be taking that quite regularly?" <i>"It's recommended. To take it regularly because it's also good for the heart, the blood, and circulation."</i> "But it's like organic vegetables. People are so use to buying commercialised vegetables that they don't see the organic side of it. It's probably the same as this stuff. They are so use to buying the ordinary sugar that they don't see any alternative and they are so focussed on other things."	320 322-323 330-333
3.1. Safety	Health and Research Issues, Safety	The condition of being safe; freedom from danger, risk, or injury.	"So thinking of immune systems and that thinking of my kids, how much Stevia is recommended?" <i>"Like research wise? Medical people, advise"</i>	780-781 786-787
3.2. Health	Health and Research Issues, Health	Soundness of body or mind; freedom from disease or abnormality.	<i>"Did you know about the health benefits that it had?"</i> "I guess for the general health of the public, things like bought biscuits"	138 757-758
3.2.1. Diabetics	Health and Research Issues, Diabetics	A person who has diabetes.	<i>"That's a big issue here in New Zealand I could read about the diabetics high rate between the Maoris also. I think that would be very... . Beneficial. Yes Yes well they just did statistics on diabetes in Maori. I think it was last week they did a report on it where they are so much higher. About forty percent higher than in European. That's a fact. Especially in the males it seems to be."</i>	699-705
Potential	Health and Research Issues, Diabetics, Potential	Anything that may be possible; a possibility; potentially.	"People with diabetes and see what is beneficial." "But certainly end products for diabetics."	695 698
Market segment	N/A			
Alternative to Artificial Sweeteners	N/A			
Natural	Health and Research Issues, Diabetics, Natural	Present in or produced by nature.	" , it sound so good, a natural way of sweetening your food" <i>"it is natural, "</i>	136 655
3.2.2. Obesity	Health and Research	The condition of being obese; increased body		

	Issues, Obesity	weight caused by excessive accumulation of fat.		
3.2.3.Replaces sugar intake	Health and Research Issues, Health, Replaces sugar intake	To use Stevia instead of sugar	<p>“The fact that you didn’t have to use sugar that you actually could cut down on sugar.”</p> <p>“Just mainly because the same, because of health,”</p> <p>“... and it replaces the sugar intake”</p> <p>“It would be good for children who are hyperactive. You know how they react with their hyper-activity with the sugar.”</p>	132 133 428 451-452
3.2.4.Is good for you	Health and Research Issues, Health, IS good for you	Stevia makes you feel good, it is healthy.	<p>“It also provides vitamins”</p> <p>“That would be most beneficial to New Zealand and children with no sugar”</p> <p>“it would be interesting to see what it was like with the Stevia and it will... Miles better for you.”</p>	309 694-695 730-732
3.2.5.Is good for teeth	N/A			
3.2.6.Has no calories	N/A			
3.3. Research	Health and Research Issues, Research	Scholarly or scientific investigation or inquiry.	<p>“So is there research there recently? <i>Yes, very recent no more than fifty – seventy years. So its pretty new.</i>”</p>	328-329
3.3.1. Interest	Health and Research Issues, Research, Interest	Involvement with or participation in something.	<p>“I want to ask you about research.”</p> <p>“It says here that it prevents the growth of Candida. What is the research on that? For people who suffer from Candida, you know women disorder there are a lot of women who cannot take sugar because of the Candida problem is there research on that or is that... ?”</p> <p>“For children?”</p>	334 334-337 340
Convenience				
4. Convenience	Convenience	The quality of being suitable to one's comfort, purposes, or needs.	From the context and predefined	
4.1. Growing	Convenience, Growing	To allow (something) to develop or increase by a natural process.	<p><i>“Where was the group from? From Manawatu, Wanganui area. They wanted to produce it as a crop? Well they thought about growing it with an eye to in the future of maybe getting a crop, but it didn’t go ahead. There’s a reason, (inaudible). I grew it one time, but didn’t realise that it dies in the winter. “</i></p> <p><i>“... and I was interested in growing some sort of crop. Still interested in growing some sort of crop.”</i></p> <p><i>“Grow your own sugar in the garden.”</i></p> <p><i>“I haven’t got a plant... down the coast a bit, which you don’t get frosts so I really thinking on growing it outdoors, but it is coastal.”</i></p> <p><i>“herbal gardens so you definitely would grow the plant... ?”</i></p> <p><i>“ALL Oh yes.”</i></p> <p><i>“How about to grow it? They grew a crop and dry it do they have well keeping, does it keep well dried?”</i></p>	117-122 133-134 136-137 396-398 655-656 657 789-790

4.1.1. Propagation	Convenience, Growing, Propagation	The process of spreading to a larger area or greater number; dissemination.	<p>“Does it flower as well?”</p> <p>“Flowering, yes. You can wait that they flower for example and you get the seeds, which you can plant them or you can cut them and they come out of the cuttings also. the earth and it will work. Directly into it.</p> <p>Can you, just poke that in?</p> <p>Yes.</p> <p>Really?”</p>	797 798-803
4.1.2. Care	Convenience, Growing, Care	the work of caring for or attending to someone or something.	<p>“they dont like frost.”</p> <p>“So what climatic conditions does it require to grow?”</p> <p>“So they are a glasshouse plant when they are in New Zealand are they?</p> <p>Yes, mainly, and a lot of water, that's every day. It likes moisture.”</p> <p>“But they have appropriate climate? Warm climate”</p> <p>“He protected them from winter yea. How far down does it die in the winter or do you cut it down?</p> <p>She said she – the first year she let it die down. The second year she cut it off and it came away much quicker.</p> <p>So if it's frost tender, could you not cover it or anything?”</p> <p>“Yes or maybe by covering the plants in the winter.”</p>	125 351 354-355 380 384-388 400
4.1.3. Ways of growing	Convenience, Growing, Ways of growing	Places or forms it can grow	<p>“Anybody looked at hydroponically growing it?”</p> <p>“What about coastal area and seas?”</p> <p>“What would coastal area be like? Mainly light soil.”</p> <p>“So they must be producing it commercially overseas?”</p> <p>“Would they produce it outside or inside a hothouse? Is it in hothouse or do they have plantations of Stevia out in the open?”</p>	356 359 365-366 373 375-376
4.1.4. Size	Convenience, Growing, Size	The physical dimensions, proportions, magnitude, or extent of a plant.	<p>“It could be in pots or does it grow too big?</p> <p><i>The largest it can get is like seventy to eighty cms wide and say the same altitude) because after that it becomes very heavy and it falls, so its good to cut it.</i></p> <p>So is it a shrub or... <i>A shrub.</i> “</p>	368-372
4.2. Application	Convenience, Application	The act of putting something to a special use or purpose.	From the context	
4.2.1. Plant	Convenience, Application, plant	A plant having no permanent woody stem; an herb.	From the context	
4.2.1.1. Cooking	Convenience, Application, Plant, cooking	To prepare, as food, by boiling, roasting, baking, broiling, etc.; to make suitable for eating, by the agency of fire or heat.	<p>“When you said you use these leaves, like you can put it in tea and then you can take it out and then back again. How many times could you use it? Could you just keep using it?”</p> <p>“I mean the same leaf. Like if you put three into your cup and you finished your cup, could you keep using the same leaf?”</p>	87-89 91-92

			<p>“Did you just keep using the leaf over and over again without getting unsweet?”</p> <p>“I wasn’t sure how to use it apart from dipping it in the tea or boiling it with water to preserve your things like that”</p> <p>“I would suggest that you would probably have to make a syrup with Stevia”</p> <p>“that’s when she boiled up the whole thing and made like a sugar syrup, which she then used for cooking fruit different fruit.”</p>	<p>95</p> <p>110-112</p> <p>421-422</p> <p>812-814</p>
4.2.1.2. Lotion	Convenience, Application, Plant, Skin and wounds	A liquid preparation for bathing the skin, or an injured or diseased part, either for a medicinal purpose, or for improving its appearance.	<p>“She said that it was fairly good for the skin as well. For wounds, in what way? <i>You directly put the leaves on the wound or –that you can boil it in water and put it on your face or wash your hair with it... ”</i></p> <p>“Have you used it? <i>Yes for wounds and as a facial lotion. You said for your skin, when it is dry ... It does, it leaves you very soft. Like for wrinkles also he says.</i>”</p> <p>“Is it a cream or a powder? Beauty products. Oh my God, great.”</p>	<p>142-143</p> <p>146-149</p> <p>153-155</p>
4.2.2. Processed products	Convenience, Application, Processed products	A series of operations performed in the making or treatment of a product.	<p><i>“The powder, for baking we use the powder.”</i></p> <p>“You used the powder for the baking? <i>For the baking.</i></p> <p>I would love to bake with Stevia. I think it will be really interesting, you see.</p> <p>Yes I’d love to experiment. I’ve always been cooking four or five batches of stuff a week.”</p> <p>“ Well what would you use? The bulk or the powder.”</p> <p><i>“Until you get the right amount. You know, baking.”</i></p>	<p>41</p> <p>227-232</p> <p>235-236</p> <p>661</p>
4.3. Form	Convenience, Form	The shape and structure of an object.	<p>“I would rather buy it.”</p> <p>“I don’t know that I could have it green. I’d rather have the extracts.”</p> <p><i>“which form would you prefer to buy.”</i></p>	<p>164</p> <p>166</p> <p>252</p>
4.3.1. Powder	Convenience, Form, Powder	A substance consisting of ground, pulverised, or otherwise finely dispersed solid particles.	<p>“It’s lovely powder. What do you use for the baking?”</p> <p><i>“The powder, for baking we use the powder.</i></p> <p>This one?</p> <p><i>Yes, that one, yes.”</i></p> <p>“See I was thinking of a baking point of view because I have children and... so that’s why I’d like the white because of baking. Green flecks through the shortbread mightn’t go down.”</p> <p>“Even younger ones will find it exciting.”</p> <p>“Particularly with jams and things like that.”</p> <p>“I think that given the white powder is advantageous. Myself, I wouldn’t worry, but I do find as you say for children.”</p>	<p>40</p> <p>41-43</p> <p>186-188</p> <p>190</p> <p>192</p> <p>194-195</p>

			<p>“... for my guests I would use the powder, it’s more like sugar, more appropriate.”</p> <p>“I find it lovely. I certainly will use it.”</p> <p>“I think I would buy white powder”</p> <p>“I’d probably have the powder if I had to choose”</p> <p>“but if I were to have products of it in the cupboard it would be the powdered form”</p>	<p>260-261</p> <p>262</p> <p>264</p> <p>271</p> <p>272-273</p>
4.3.2. Liquid extract	Convenience, Form, Liquid extract	A concentrated preparation of the essential constituents of a food, flavouring, or other substance; a concentrate flowing freely like water; fluid; not solid.	<p>“The liquid extract would take a bit more getting used to than the powder. I think to have the two I’d be getting confused”</p> <p>“And what is the difference between these 2 extracts?”</p> <p><i>One is dark and the other clear.</i>”</p>	<p>273-274</p> <p>281-282</p>
4.3.3. Plant	Convenience, Form, Plant	Idem 4.2.1.	<p>“I’ll use the leaves.”</p> <p>“I probably like the idea of green and say reusable ingredients.”</p> <p>“... but I rather will be quite happy to throw a leaf in a sweet drink, but I don’t like to really drink it.”</p> <p>“I am thinking I probably will use the plant. But it doesn’t bother me to see the green leaves”</p> <p>“... but then I would certainly invest in trying and experimenting with the plant and go out and take some leaves instead of going to the shop. “</p> <p>“I would probably go for the plant as well”</p> <p>“I would choose to have the plant”</p> <p>“That’s why I love the idea of actually growing my own.”</p>	<p>180</p> <p>182</p> <p>197</p> <p>259-260</p> <p>264-266</p> <p>268</p> <p>272</p> <p>396</p>
4.3.4. Others	Convenience, Form, Others	Idem 2.3.4.	<p>“I am happy to use both.”</p> <p>“Well I’m a bit like her, I have a little of everything. I love the idea of being completely organic”</p>	<p>254</p> <p>394-395</p>

APPENDIX 5

Definition Table 3: Diabetics

Table A.3. Definition table of the Diabetics focus group

N/A = No answers or discussion

Category	Location	Definition	Data bits- Evidence	Line number
Potential use of Stevia in New Zealand				
Sensory Evaluation				
1. Sensory Evaluation	Sensory evaluation	To examine and judge carefully; the transmission of impulses from sense organs to nerve centres. Especially the taste and touching senses.	From the context	
1.1. Sweetness	Sensory evaluation, Sweetness	The property of having a pleasantly sweet taste. The quality or state of being sweet (in any sense of the adjective); gratefulness to the taste or to the smell; agreeableness.	From the context	
1.1.1. Positive responses	Sensory evaluation, Sweetness, Positive responses	Characterised by or displaying certainty, acceptance, or affirmation answers.	“Sweetness in my mouth until now.” “I could taste the sweetness” “no excess sweetness in butter-cookies” “tasted just adequately sweet” “exceptional sweet tasting”	153 172 174-175 177 177-178
1.1.2. Negative response	Sensory evaluation, Sweetness, Negative response	Expressing, containing, or consisting of a negation, refusal, or denial answer.	“excess sweetness in coffee” “too sweet”	168 170
1.2. Flavour	Sensory evaluation, Flavour	That quality of anything which affects the taste; that quality which gratifies the palate	From the context	
1.2.1. Positive responses	Sensory evaluation, Flavour, Positive responses	Idem 1.1.1.	“The orange juice is very nice.” “It tastes good” “... can you do the concentrate by yourself? It was nice” “This apple cake tastes nice,” “the butter-cookies very nice and the orange juice was very nice” “I found the orange juice good, very nice to eat” “very good” “orange juice was very refreshing” “butter-cookies taste like I would cook at home” “food was ok” “, I appreciated that the flavour was not altered or bitter” “I have tried the leaves, they taste good.”	126 129 130 160 172-173 173 176 176 176-177 178 178-179 254

1.2.2. Negative responses	N/A			
1.3. Aftertaste	Sensory evaluation, Aftertaste	A taste persisting in the mouth after the substance that caused it is no longer present.	From the context	
1.3.1. Positive responses	Sensory evaluation, Aftertaste, Positive responses	Idem 1.1.1.	"taste with no aftertaste" "no aftertaste" "no aftertaste"	174 174 175
1.3.2. Negative responses	Sensory evaluation, Aftertaste, Negative responses	Idem 1.1.2.	"left sweet taste in the mouth afterwards"	169
1.4. Quantity	Sensory evaluation, Quantity	A specified or indefinite number or amount	"Could you tell me, one of these is equivalent of ... then sugar" "How much is too much?"	111 255
1.5. Texture	Sensory evaluation, Texture	The appearance and feel of a surface	"some dryness in the butter-cookies"	168-169
1.6. Appearance	Sensory evaluation, Appearance	Outward or visible aspect of a person or thing.	"It doesn't matter it's just the colour which is different."	133
Market Issues				
2. Market issues	Market Issues	Something proceeding from the world of commercial activity where goods and services are bought and sold.	From the context	
2.1. Information	Market Issues, Information	Knowledge derived from study, experience, or instruction.	From the context	
2.1.1. General information	Market Issues, Information, General information	Data and facts about Stevia in general terms.	"How much is too much?" "I am not sure how to utilise it? do you know?" "How did you dry the leaves?" "... because they use different fillers. Oh really, What fillers? <i>Lactose, maltodextrin, F.O.S., dextrose.</i> "	255 264 274 314-316
2.2. Marketing Issues	Market Issues, Marketing issues	The commercial functions involved in transferring goods from producer to consumer.	"What things do you consider important when buying a sweetener, what do you look after?"	76-77
2.2.1. Price	Market Issues, Marketing issues, Price	The amount as of money or goods, asked for or given in exchange for something else	"Price "So, the price issue, is it important for you as well?" "Yes it is an issue." "Yes it is." "It is important" "Yes, but it depends as well." "Everything" "selling the plants for NZ\$ 5 dollars." "Yes in the Plant Growth Unit". "Each plant? "Yes 5 dollars each." "What about the cost of these? How much does it cost?"	84 85 86 87 88 89 90 230 231 232 233 292
2.2.2.	Market	Something produced by	"Taste, the product	79

Product	Issues, Marketing issues, Product	human or mechanical effort or by a natural process	<p>“It depends, what product we are talking about.”</p> <p>“The content.”</p> <p>“The form is important.”</p> <p>“A bit of all.”</p> <p>“There is trouble trying to get the other forms.”</p> <p>“But you have to consider it is 200 times sweeter, isn't it? So you don't need a lot of it.”</p>	<p>80</p> <p>81</p> <p>82</p> <p>83</p> <p>148</p> <p>294</p>
2.2.3. Place	Market Issues, Marketing issues, Place	A channel of distribution comprises a set of institutions which perform all of the activities utilised to move a product and its title from production to consumption.	<p>“In the Plaza shop.”</p> <p>“Not being able to get it freely in NZ”</p> <p>“not ready available in NZ”</p> <p><i>“the health shops and here in Palmerston as I said before in the Plaza Shopping in the Health Shop they are selling it as well”</i></p> <p>“And in Massey shop they are selling the plants for NZ\$ 5 dollars. <i>Yes in the Plant Growth Unit. ”</i></p> <p>“I would like to find some of these products on the shelves in the supermarket.”</p> <p>“Sorry where is the place where I can get more plants? <i>The PGU at Massey... ”</i></p>	<p>145</p> <p>168</p> <p>169-170</p> <p>227-229</p> <p>230-231</p> <p>260</p> <p>319-320</p>
2.3. New Products	Market Issues, New products	Not previously experienced or encountered; novel or unfamiliar product.	<p><i>“would you suggest some way Stevia could be used in another way as in your own homes or in your own cooking, would you for example buy products that use Stevia? ”</i></p>	183-185
2.3.1. Drinks	Market Issues, New products, Drinks	To take into the mouth and swallow (a liquid).	<p>“Soft drinks.”</p> <p>“Yes I would buy that, I am very impressed.”</p> <p>“Drinks, drinks maybe.”</p> <p>“Yes, definitely.”</p>	<p>186</p> <p>187</p> <p>189</p> <p>190</p>
2.3.2. Bakery	Market Issues, New products, Bakery	Products such as bread, cake, and pastries are baked or sold	<p>“Or baked products.”</p>	188
2.3.3. Sweets	N/A			
2.3.4. Dairy products	Market Issues, New products, Dairy products	Products made out of milk or its derivatives	<p>“Dairy products”</p>	188
2.3.5. Others	Market Issues, New products, Others	Different from that or those implied or specified before.	<p>“And other suggestions that you could make?”</p> <p>“Yes, I have one.”</p> <p>“Muesli bars. The available ones only are made with sugar, most of them with chocolate. So this could be interesting.”</p>	<p>191</p> <p>192</p> <p>194-195</p>
2.4. Competition	Market Issues, Competition	One that competes with another; a rival	<p><i>“And what sweeteners do you normally use now?”</i></p>	91
2.4.1. Sugar	Market Issues, Competence, Sugar	A sweet crystalline or powdered substance, white when pure, consisting of sucrose obtained mainly from sugar cane and sugar beets and used in many foods, drinks, and	<p>“I use sugar for some of my cooking.”</p>	101

		medicines to improve their taste.		
2.4.2. Artificial sweeteners	Market Issues, Competence, Artificial sweeteners	A sweet substance added to food or drinks to improve its flavour.	<p>"I usually use Splenda."</p> <p>"Yes Splenda."</p> <p>"Me too."</p> <p>"Because it is the only one that... , because I have a young daughter with diabetes."</p> <p>"It has an aftertaste"</p> <p>"But I find at least , I find that with Splenda I can cook with it."</p> <p>"<i>Splenda is aspartame</i>"</p> <p>"It is a powder. Ah yes."</p> <p>"Yes it is."</p>	<p>92</p> <p>93</p> <p>94</p> <p>95</p> <p>96</p> <p>97</p> <p>98</p> <p>99</p> <p>100</p>
2.4.3. Others	N/A			
Health and Research issues				
3. Health and Research Issues	Health and Research Issues	Things related to the soundness of body or mind; freedom from disease or abnormality; and about scholarly or scientific investigation or inquiry.	From the context	
3.1. Safety	Health and Research Issues, Safety	The condition of being safe; freedom from danger, risk, or injury.	<p>"So if there are concerns by health professionals how is it allowed to be sold. You know it seems to be a little of concern."</p> <p>"You know some health professional might come and say this... "</p>	<p>203-204</p> <p>205</p>
3.2. Health	Health and Research Issues, Health	Soundness of body or mind; freedom from disease or abnormality.	<p>"being able to use in cooking without any side effects"</p> <p>"does it lower pressure?"</p>	<p>175</p> <p>180</p>
3.2.1. Diabetics	Health and Research Issues, Diabetics	A person who has diabetes.	From the context	
Potential	Health and Research Issues, Diabetics, Potential	Anything that may be possible; a possibility; potentially.	"We dont need too much sweetening anyway. And this appears to solve our problem"	291
Market segment	N/A			
Alternative to Artificial Sweeteners	Health and Research Issues, Diabetics, Alternative to artificial sweeteners	The course of action or the thing (Stevia) offered in place of artificial sweeteners	"As a sugar substitute it isn't allowed in some places, but they call it dietary supplement."	214
Natural	N/A			
3.2.2. Obesity	N/A			
3.2.3. Replaces sugar intake	Health and Research Issues, Health, Replaces sugar intake	To use Stevia instead of sugar	"So I can cut sugar anyway."	270
3.2.4. Is good for you	N/A			
3.2.5. Is	N/A			

good for teeth				
3.2.6. Has no calories	N/A			
3.3. Research	Health and Research Issues, Research	Scholarly or scientific investigation or inquiry.	<p>“Because they do research”</p> <p><i>“all the research that has been done had negative results as I said before”</i></p> <p><i>“using one research that was done many years ago by a Brazilian man who said it could cause reproductive problems”</i></p> <p>“There should be some more research done. These several papers they showed that over-dosage may affect reproductive system of men,”</p> <p>“To catch attention they should have more research done, even in New Zealand”</p>	206 207-208 208-210 217-218 225
3.4.1. Interest	Health and Research Issues, Research, Interest	Involvement with or participation in something.	“I can't see why Stevia could not be used as a sweetener?”	290
3.5. Obesity	N/A			
Convenience				
4. Convenience	Convenience	The quality of being suitable to one's comfort, purposes, or needs.		
4.1. Growing	Convenience, Growing	To allow (something) to develop or increase by a natural process.	“Would you be able to gardening the plant?”	243
4.1.1. Propagation	Convenience, Growing, Propagation	The process of spreading to a larger area or greater number; dissemination.	<i>“... you can try even to make the cuttings out of them as I told you before cut them,”</i>	244-245
4.1.2. Care	Convenience, Growing, Care	the work of caring for or attending to someone or something.	<p><i>“they keep very well for a long time also. And when they grow bigger you can try even to make the cuttings out of them as I told you before cut them, put them in the earth and they will grow like that. So they grow as easy as that?... ”</i></p> <p>“Do you need to fertilise the plant?”</p> <p><i>“It's not necessary as far as I know, but if you want better results you can.”</i></p>	244-247 309 310
4.1.3. Outside – inside	Convenience, Growing, Outside – inside	Outdoors. Indoors.	<p>“Do you think that they will grow outside like that?”</p> <p>“So they should grow inside?”</p> <p>“I have got one that is growing in a porch way, that I have for a year and it is growing pretty well.”</p> <p>“Where abouts do you grow it onwards, do you grow it outside?”</p> <p>“Outside during summer but I'll bring it inside during the winter.”</p>	247 249 251-252 278 279
4.1.4. Species - variety	Convenience, Growing, Variety	A fundamental category of taxonomic classification, ranking below a genus or subgenus and consisting of related organisms capable of inter-breeding. An organism,	<p>“What about the species? Are there different species or is this the only one?”</p> <p><i>“There are different species but this is the sweet one and almost all the others are in extinction.</i></p> <p>Are these plants the same as the ones you have got in Paraguay?”</p>	303 304-306

		especially a plant, belonging to such a subdivision.		
4.2. Application	Convenience, Application	The act of putting something to a special use or purpose.	From the context	
4.2.1. Plant	Convenience, Application, Plant	A plant having no permanent woody stem; an herb.	"I am not sure how to utilise it? do you know?"	264
4.2.1.1. Cooking	Convenience, Application, Plant, cooking	To prepare, as food, by boiling, roasting, baking, broiling, etc.; to make suitable for eating, by the agency of fire or heat.	"can use the whole leaf to sweeten food or not?" "Could you cook with like taking a couple of leaves on and put it in a rhubarb would it work like that to sweeten something?"	135 240-241
4.2.1.2. Lotion	N/A			
4.2.2. Processed products	Convenience, Application, Processed products	A series of operations performed in the making or treatment of a product.	"easy of use in coffee" "I would like cooking lessons and how to adapt my recipes for use with Stevia" " <i>For jam making I think it isnt good</i> " "Making jam with it could be possible, fruit or yellow cream, and using amounts of Stevia and you could seal the bottles with a little wax like some people did that would be the idea of preserving it. I use other preserving methods as well instead of sugar."	174 179-180 281 286-289
4.3. Form	Convenience, Form	The shape and structure of an object.	" <i>What form or presentation would you prefer to buy if buying finished products,</i> " " <i>why would you prefer the powder,</i> " "All the recipes I have got are very basic to follow, each had a different stuff, you know, powder, or... some say this, some ... ups what is that"	49 64 145-146
4.3.1. Powder	Convenience, Form, Powder	A substance consisting of ground, pulverised, or otherwise finely dispersed solid particles.	"The powder" "The powder" "Yes, the powder." "I don't know, I can't decide yet." "One using it in cooking and in your drinks, its easier to measure, for measuring it." "Easier to use." "Probably because the tradition in sweets and in cooking, sugar is a dry ingredient." "Yes that's true."	51 52 53 54 65 66 67 68
4.3.2. Liquid extract	Convenience, Form, Liquid extract	A concentrated preparation of the essential constituents of a food, flavouring, or other substance; a concentrate flowing freely like water; fluid; not solid.	"... <i>the liquid extracts?</i> " "We probably need help with some cooking lessons." "I just was going to say that. Cooking lessons would be a good thing... " "but once having a couple of demonstrations or something like that... "	55 56 57 63
4.3.3. Plant	Convenience, Form, Plant	Idem 4.2.1.	"I am not sure the leaves... how do you dry them to store them? Is it possible to do it yourself?"	261-262
4.3.4. Others	Convenience, Form, Others	Idem 2.3.4.	" <i>And, if available as tea bags would you be interested as well?</i> " "Yes, a potential sweet drink isn't it?" "Naturally growing." "We do not know actually"	70 71 73 74

APPENDIX 6

Definition Table 4: Maori

Table A.4. Definition table of the Maori focus group

N/A = No answers or discussion

Category	Location	Definition	Data bits- Evidence	Line number
Potential use of Stevia in New Zealand				
Sensory Evaluation				
1. Sensory Evaluation	Sensory evaluation	To examine and judge carefully; the transmission of impulses from sense organs to nerve centres. Especially the taste and touching senses.	From the context	
1.1. Sweetness	Sensory evaluation, Sweetness	The property of having a pleasantly sweet taste. The quality or state of being sweet (in any sense of the adjective); gratefulness to the taste or to the smell; agreeableness.	From the context	
1.1.1. Positive responses	Sensory evaluation, Sweetness, Positive responses	Characterised by or displaying certainty, acceptance, or affirmation answers.	"Probably I did notice the sweetness, I'm the opposite, but not like sugar."	169
1.1.2. Negative response	Sensory evaluation, Sweetness, Negative response	Expressing, containing, or consisting of a negation, refusal, or denial answer.	"It was a bit hard to tell because these aren't very sweet." "Just eating a bit like that, not a lot of sweetness in it so it is hard for me to say." "It is probably just the recipe. You may want to up it a bit next time you do it."	166 168 170
1.2. Flavour	Sensory evaluation, Flavour	That quality of anything which affects the taste; that quality which gratifies the palate	From the context	
1.2.1. Positive responses	Sensory evaluation, Flavour, Positive responses	Idem 1.1.1.	"It was O.K." "Different taste to the sugar and for me"	164 167
1.2.2. Negative responses	N/A			
1.3. Aftertaste	Sensory evaluation, Aftertaste	A taste persisting in the mouth after the substance that caused it is no longer present.	"Was there an aftertaste that you felt?"	171
1.3.1. Positive responses	Sensory evaluation, Aftertaste, Positive	Idem 1.1.1.	"Not in the food." "ALL No, not really" "No."	172 174 175

	responses			
1.3.2. Negative responses	Sensory evaluation, Aftertaste, Negative responses	Idem 1.1.2.	"Possibly in the orange juice, but that might have been the orange juice itself so, don't take that into consideration."	172-173
1.4. Quantity	Sensory evaluation, Quantity	A specified or indefinite number or amount	"you said about what, a quarter of a teaspoon is about the same as a teaspoon of sugar?"	89
1.5. Texture	Sensory evaluation, Texture	The feel of a surface		
1.6. Appearance	Sensory evaluation, Appearance	Outward or visible aspect of a person or thing.		
Market Issues				
2. Market issues	Market Issues	Something proceeding from the world of commercial activity where goods and services are bought and sold.	From the context	
2.1. Information	Market Issues, Information	Knowledge derived from study, experience, or instruction.	From the context	
2.1.1. General information	Market Issues, Information, General information	Data and facts about Stevia in general terms.	"How well is Stevia doing as far as sales?" "By the sounds it's doing pretty good." "You said that (inaudible) commercially is grown in Japan?" "Growing, not so much..." "But they produce it in Japan, so where do they grow it?" "In Paraguay and China there is a lot of growing as well. China is Y think the biggest grower. In Canada they are growing it as well"	140 144 149 150 152-153
2.1.1.1. Fillers	Market Issues, Information, General information, Fillers	Something added to augment weight or size or fill space.	"Also I have list of fillers you had when there was things like lactose and dextrose and maltose. I have a lactose problem. I can't take too much lactose, but also the other things like dextrose and maltose are still sugars and a lot of people won't know that anyway. They think they are getting something that's sugar free and it's not."	83-87
2.2. Marketing Issues	Market Issues, Marketing issues	The commercial functions involved in transferring goods from producer to consumer.	"what things do you consider important when buying a sweetener?"	104-105
2.2.1. Price	Market Issues, Marketing issues, Price	The amount as of money or goods, asked for or given in exchange for something else	"It would depend on cost I suppose as well, for production costs maybe." "What would this ones cost, do you know?" "Yea, what would be the price?" "One of those containers" "I am not able to pay for something now." "Probably mostly price." "It's a little expensive; looking at these prices they are a little expensive."	50 50-51 52 53 63 83 205
2.2.2. Product	Market Issues, Marketing issues, Product	Something produced by human or mechanical effort or by a natural process	"I suppose it would come down you might need a lot of time changing people's opinion. If somebody consumes sugar for 30 to 40 years they probably will be quite resistant to change"	207-209

2.2.3. Place	Market Issues, Marketing issues, Place	A channel of distribution comprises a set of institutions which perform all of the activities utilised to move a product and its title from production to consumption.	“Not being able to buy it. Can you buy it at the supermarkets and stuff?” “In the health food shops.”	202 203
2.3. New Products	Market Issues, New products	Not previously experienced or encountered; novel or unfamiliar product.	From the context	
2.3.1. Drinks	N/A			
2.3.2. Bakery	N/A			
2.3.3. Sweets	Market Issues, New products, Sweets	Foods, such as candy, pastries, puddings, or preserves,	From the context	
2.3.4. Dairy products	N/A			
2.3.5. Others	Market Issues, New products, Others	Different from that or those implied or specified before.	“For jam or anything like that?” “... and skin products”	40 199
2.4. Competition	Market Issues, Competition	Rivalry between two or more businesses striving for the same customer or market.	From the context	
2.4.1. Sugar	Market Issues, Competition, Sugar	A sweet crystalline or powdered substance, white when pure, consisting of sucrose obtained mainly from sugar cane and sugar beets and used in many foods, drinks, and medicines to improve their taste.	“It doesn't have sugar like properties does it? For example, you couldn't make toffee out of Stevia.” “You couldn't get it to caramelize or” “I buy sugar, just general sugar off the shelf. So I don't worry about that. It is not presented nicely. Doesn't really matter how sugar is presented. Sugar is sugar.” “I might have a problem with not being able to use it for the things that you can use sugar for. Say I like to make a fudge or something like that and buying two things to do the job of one seems a bit redundant.” “It's just really breaking out of that habit of just sugar all the time. You know what I mean? Kind of like giving up alcohol, right? You know, we're in that habit of just buying that normal sugar.”	35-36 38 108-110 117-119 120-123
2.4.2. Artificial sweeteners	N/A			
2.4.3. Others	N/A			
Health and Research issues				
3. Health and Research Issues	Health and Research Issues	Things related to the soundness of body or mind; freedom from disease or abnormality; and about scholarly or scientific investigation or inquiry.	From the context	
3.1. Safety	Health and Research Issues, Safety	The condition of being safe; freedom from danger, risk, or injury.		

3.2. Health	Health and Research Issues, Health	Soundness of body or mind; freedom from disease or abnormality.	From the context	
3.2.1. Diabetics	Health and Research Issues, Diabetics	A person who has diabetes.	"... for an extremely severe diabetic, it might still have an effect if they are using" "If it does have hypoglycaemic action and lowers blood sugar, then the most dangerous thing for a diabetic is low blood sugar, not high blood sugar."	87-88 184-186
Potential	N/A			
3.3.2. Market segment	N/A			
Alternative to Artificial Sweeteners	N/A			
Natural	N/A			
3.2.2. Obesity	Health and Research Issues, Obesity	The condition of being obese; increased body weight caused by excessive accumulation of fat.	"The major advantages I can see were related to the weight loss" "Weight loss. It would be useful for that." "Yes true,"	183 197-198 199
3.2.3. Replaces sugar intake	N/A			
3.2.4. Is good for you	N/A			
3.2.5. Is good for teeth	Health and Research Issues, Health, Is good for teeth	Stevia is said not to damage teeth	"Is it better for your teeth?" "Yes. It's a plaque retardant and also an anti-caries." "I like that it's not so hard on your teeth. I worry about teeth."	147 148 181
3.3. Research	Health and Research Issues, Research	Scholarly or scientific investigation or inquiry.	"Possibly a bit of research would have to be done to find out." "The product needs some more research, doesn't it?"	115 195
Convenience				
4. Convenience	Convenience	The quality of being suitable to one's comfort, purposes, or needs.	From the context	
4.1. Growing	Convenience, Growing	To allow (something) to develop or increase by a natural process.	"So having the plant, would you like to grow it yourself" "I would grow it my own." "I'd probably grow my own." "I'd probably grow my own." "I'm the same. I'd probably grow it." "Finished growing the veggie garden now." "I'll probably grow it."	57-58 59 60 61 62 65 66
4.1.1. Propagation	N/A			
4.1.2. Care	N/A			
4.2. Application	Convenience, Application	The act of putting something to a special use or purpose.	From the context	
4.2.1. Plant	Convenience, Application, Plant	A plant having no permanent woody stem; an herb.		
4.2.1.1. Cooking	Convenience, Application, Plant, cooking	To prepare, as food, by boiling, roasting, baking, broiling, etc.; to make suitable for		

		eating, by the agency of fire or heat.		
4.2.1.2. Lotion	Convenience, Application, Plant, Skin and wounds	A liquid preparation for bathing the skin, or an injured or diseased part, either for a medicinal purpose, or for improving its appearance.		
4.2.2. Processed products	Convenience, Application, Processed products	A series of operations performed in the making or treatment of a product.	"For baking, that's all right"	45
4.3. Form	Convenience, Form	The shape and structure of an object.	<p>"So having the plant, would you like to grow it yourself or would you prefer to buy it in a commercial form, or both?"</p> <p>"I would buy them at the moment."</p> <p>"It costs me too much to grow it, because I don't know how to grow things so I'd buy it."</p> <p>"I probably would buy it too."</p> <p>"Yea, buy it."</p> <p>"Well for me anyway, probably an educational process in just having to watch it grow and then perhaps buy it at the end would probably be in my case. It's watching a nutrient (inaudible), I could not say properly why.</p> <p>Yes me too."</p> <p><i>"what form or presentation would you prefer to buy if buying finished products."</i></p>	<p>57-58</p> <p>64</p> <p>67-68</p> <p>70</p> <p>73</p> <p>78-81</p> <p>93-94</p>
4.3.1. Powder	Convenience, Form, Powder	A substance consisting of ground, pulverised, or otherwise finely dispersed solid particles.	<p>"Probably powder, similar use to sugar."</p> <p>"I agree. Yeah."</p> <p>"Me too."</p> <p>"Powder is easy to measure not like the liquid."</p>	<p>101</p> <p>102</p> <p>103</p> <p>213</p>
4.3.2. Liquid extract	Convenience, Form, Liquid extract	A concentrated preparation of the essential constituents of a food, flavouring, or other substance; a concentrate flowing freely like water; fluid; not solid.	<p>"The liquid extract, is that just as (inaudible) dissolved in a sugary... out of the bottle? So it would have a certain amount of flavour from the leaf on it?"</p> <p><i>"And the advantages you can find in the liquid extract?"</i></p> <p>Easier to dissolve in a drink I suppose.</p> <p>Dissolves easily."</p>	<p>135-136</p> <p>217-219</p>
4.3.3. Plant	Convenience, Form, Plant	Idem 4.2.1.	<p>"I would grow it my own."</p> <p>"I'd probably grow my own."</p> <p>"I'd probably grow my own."</p> <p>"I'm the same. I'd probably grow it."</p> <p>"Finished growing the veggie garden now."</p> <p>"I'll probably grow it."</p>	<p>59</p> <p>60</p> <p>61</p> <p>62</p> <p>65</p> <p>66</p>
4.3.4. Others	Convenience, Form, Others	Idem 2.3.4.	<p>"Tablets are easier for me just drop them in."</p> <p>"With a tablet, you can't really use a tablet for cooking. Just for drinks."</p> <p>"But you'd sprinkle it can't you.</p> <p>You can put too much on recipes."</p> <p><i>"For the packs, do you find it an advantage or a disadvantage for them?"</i></p> <p>When you've run out you would probably – because it's a smaller pack, you'd need a bigger pack or else you'd be at the supermarket or the health shop all the time. It's too small. "</p>	<p>96</p> <p>213-214</p> <p>215-216</p> <p>220-223</p>

			<p><i>“And for the tablet?</i> I wouldn't have a use for tablet I don't think, only for drinks. Yea, for a drink the tablet would be all right. Only for that.”</p>	224-227
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APPENDIX 7

General Public charts

Figure A.1. General Public's Sensory Evaluation chart

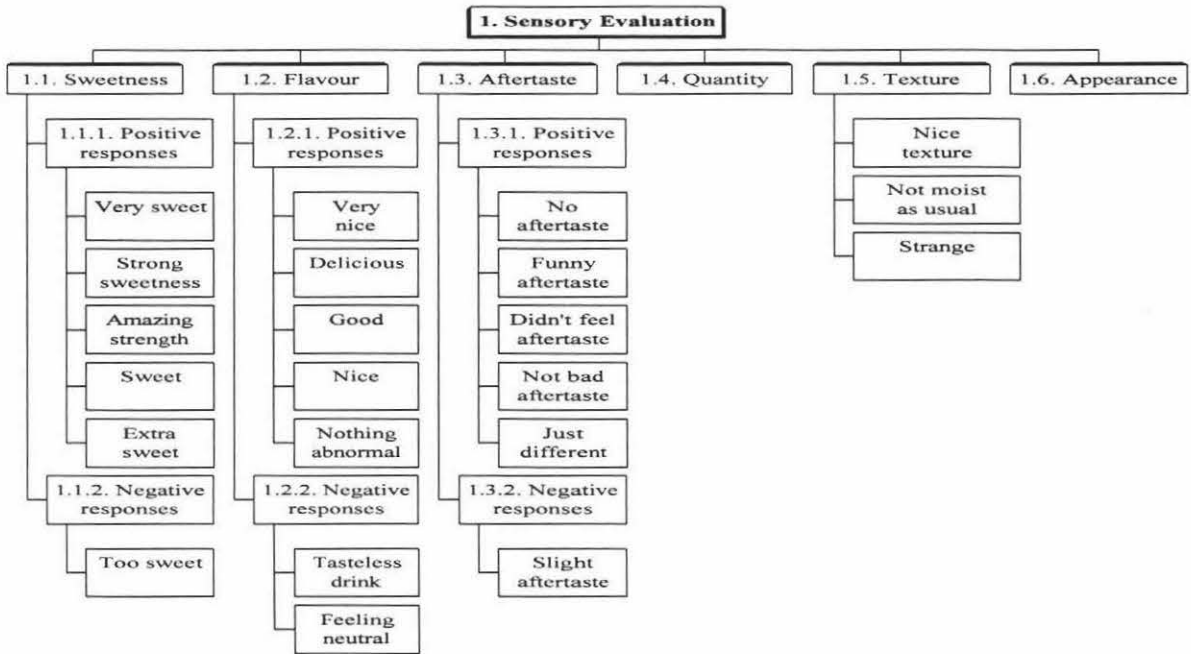


Figure A.2. General Public's Market Issues chart

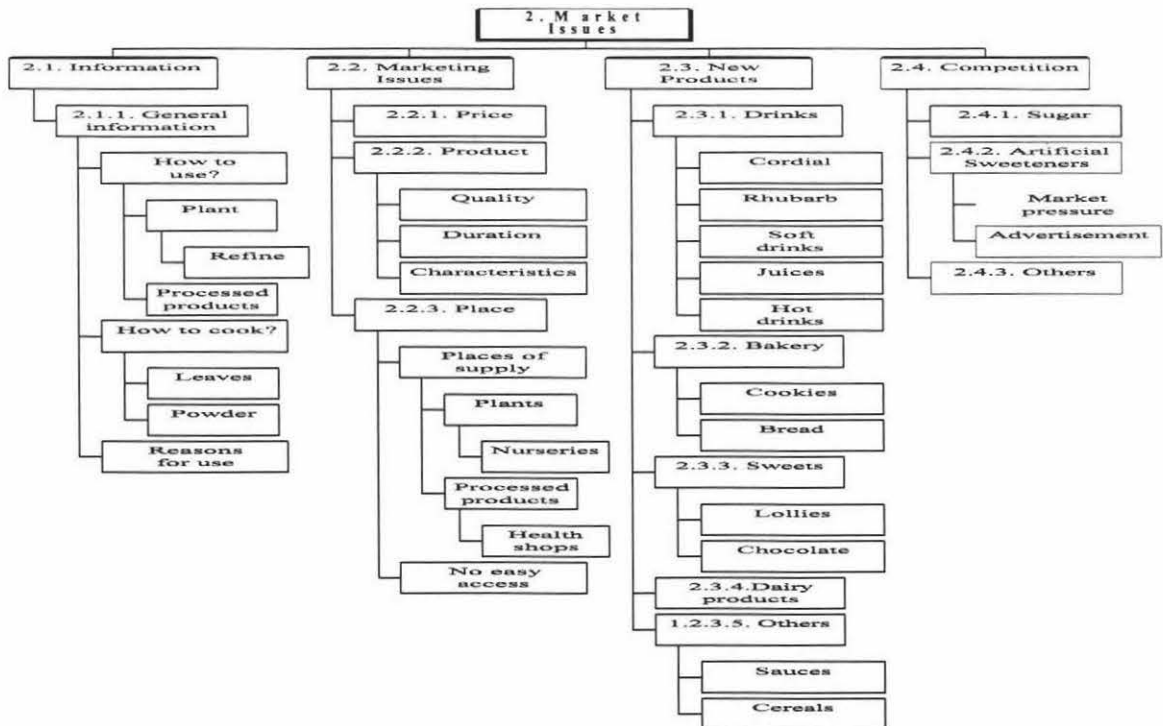


Figure A.3. General Public's Health and Research Issues chart

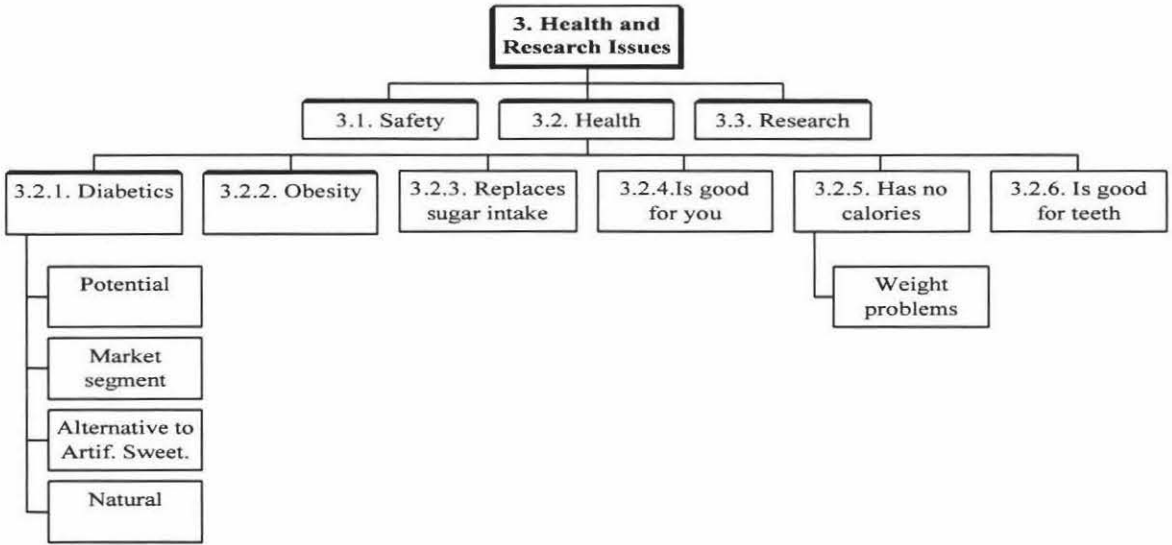
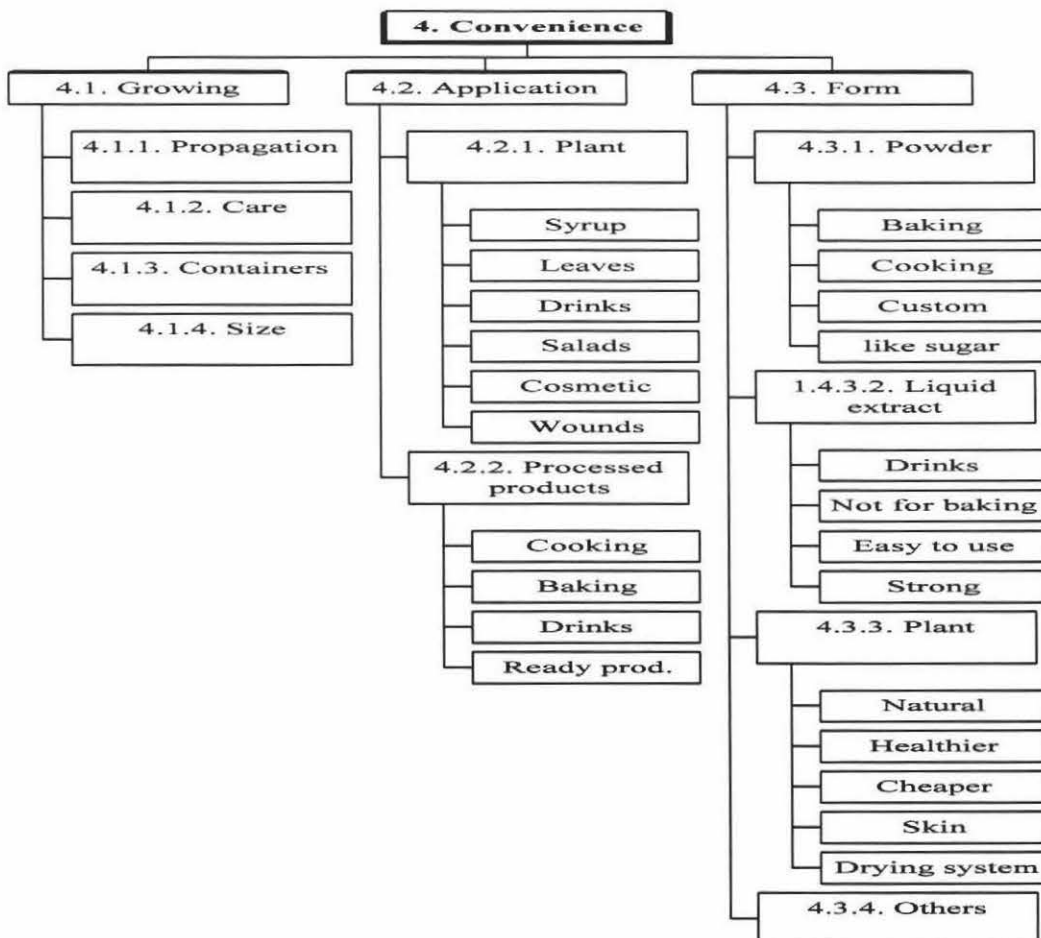


Figure A.4. General Public's Convenience chart



APPENDIX 8

Herb Experts charts

Figure A.5. Herb Experts' Sensory Evaluation chart

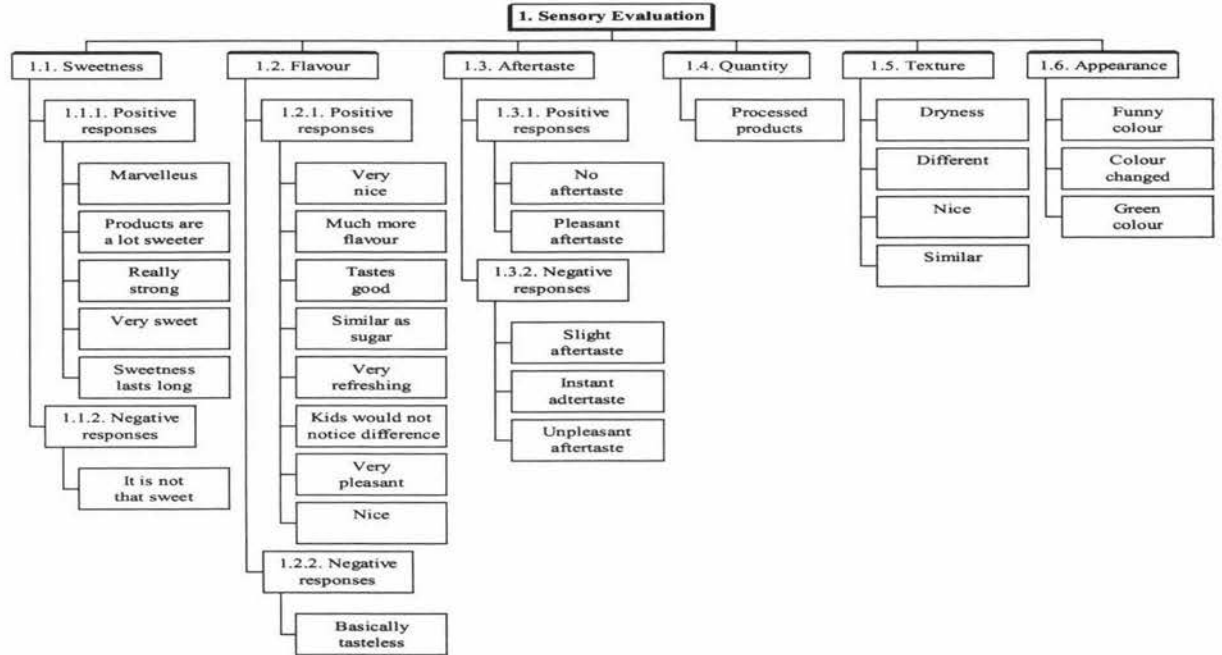


Figure A.6. Herb Experts' Market Issues chart

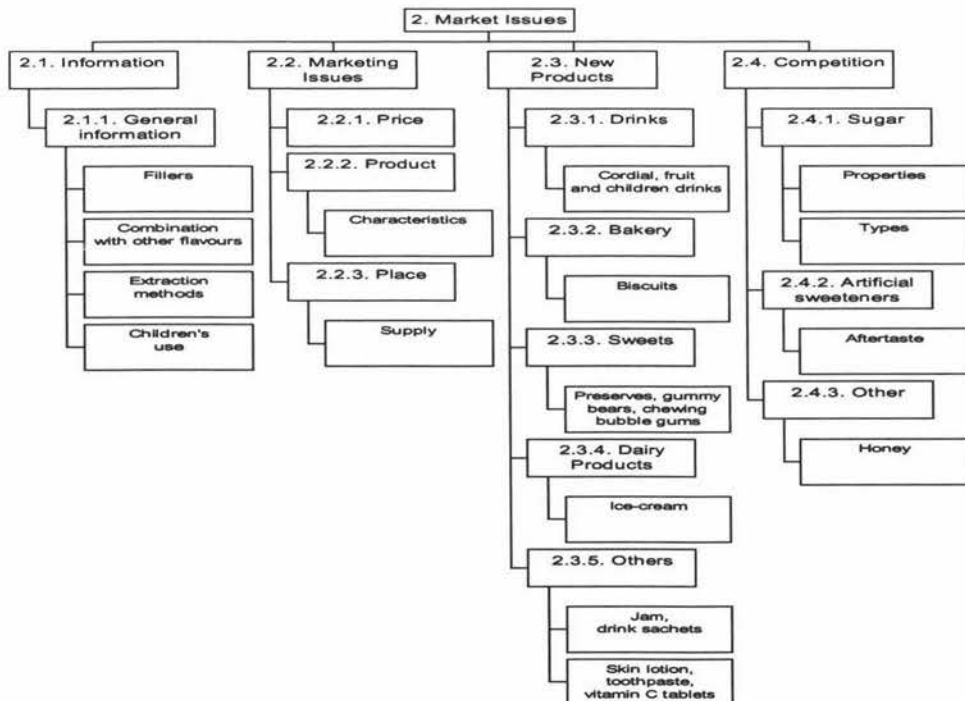


Figure A.7. Herb Experts' Health and Research Issues chart

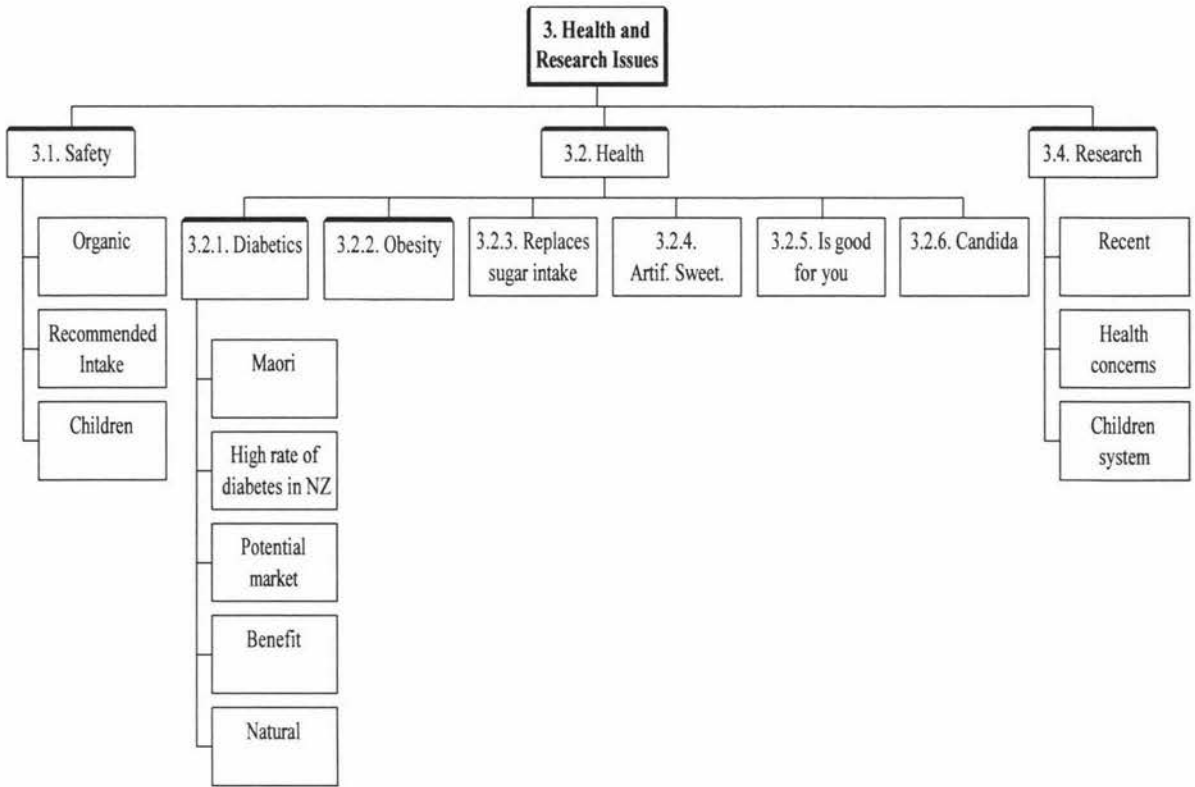
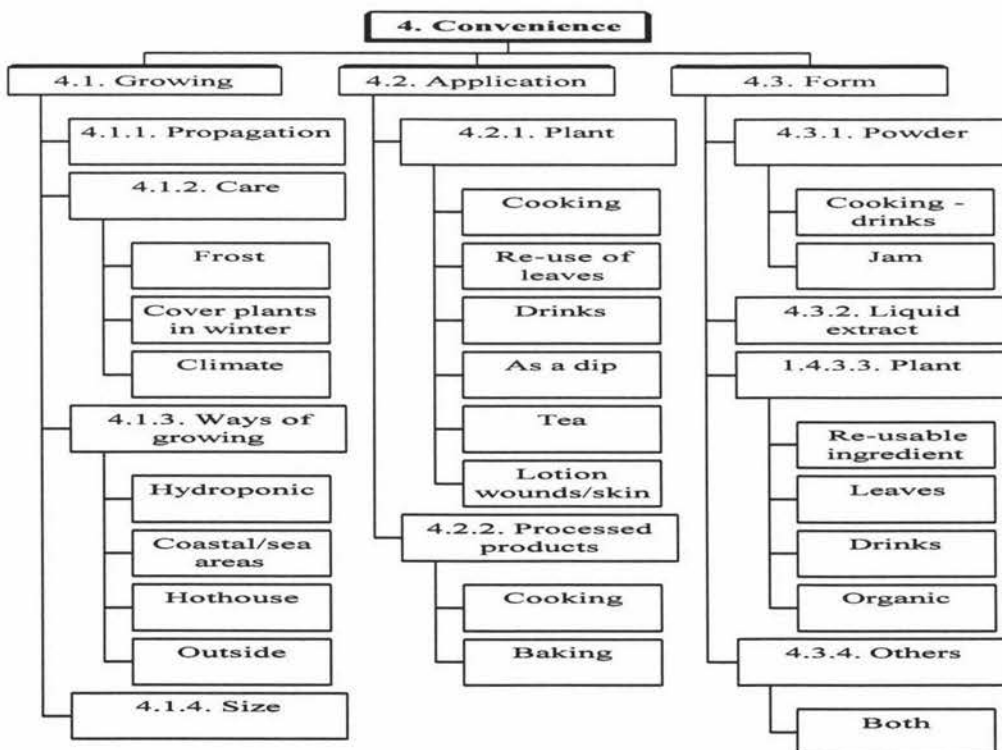


Figure A.8. Herb Experts' Convenience chart



APPENDIX 9

Diabetics charts

Figure A.9. Diabetics' Sensory Evaluation chart

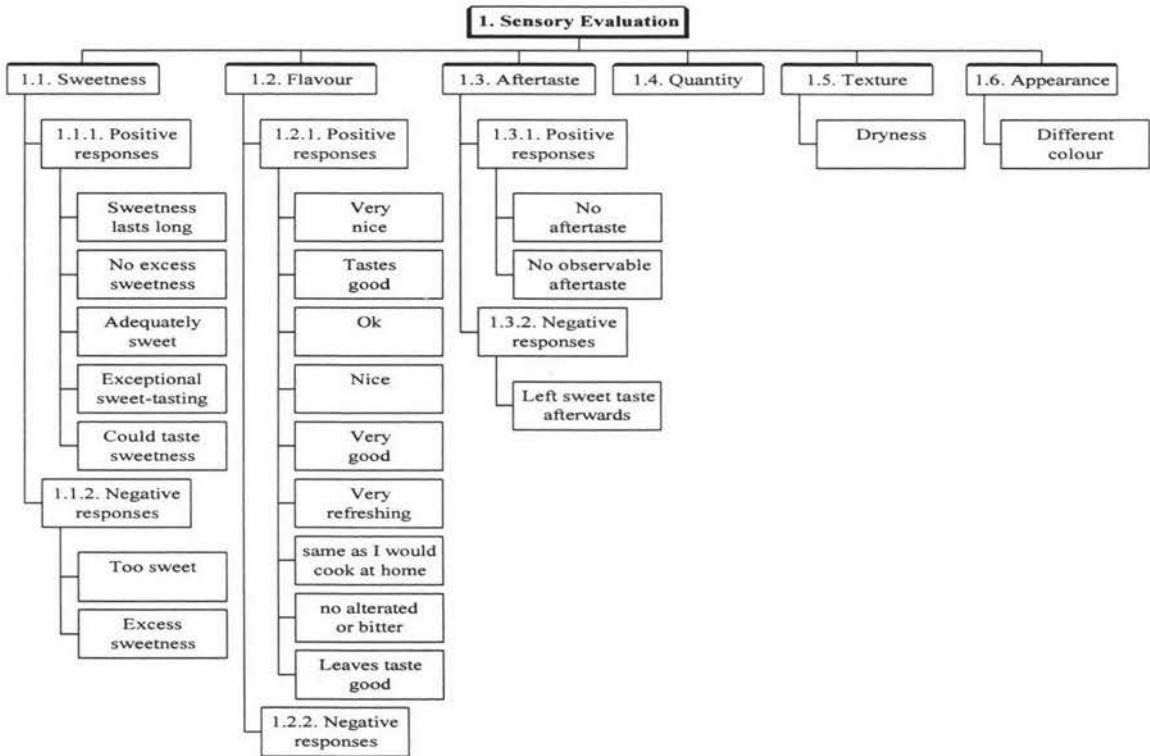


Figure A.10. Diabetics' Market Issues chart

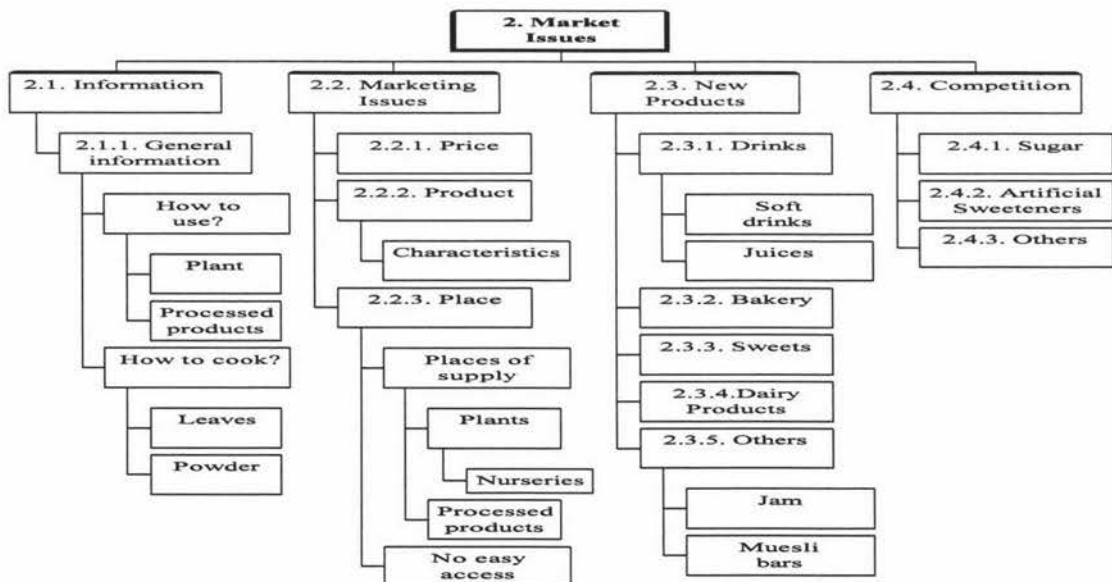


Figure A.11. Diabetics' Health and Research Issues chart

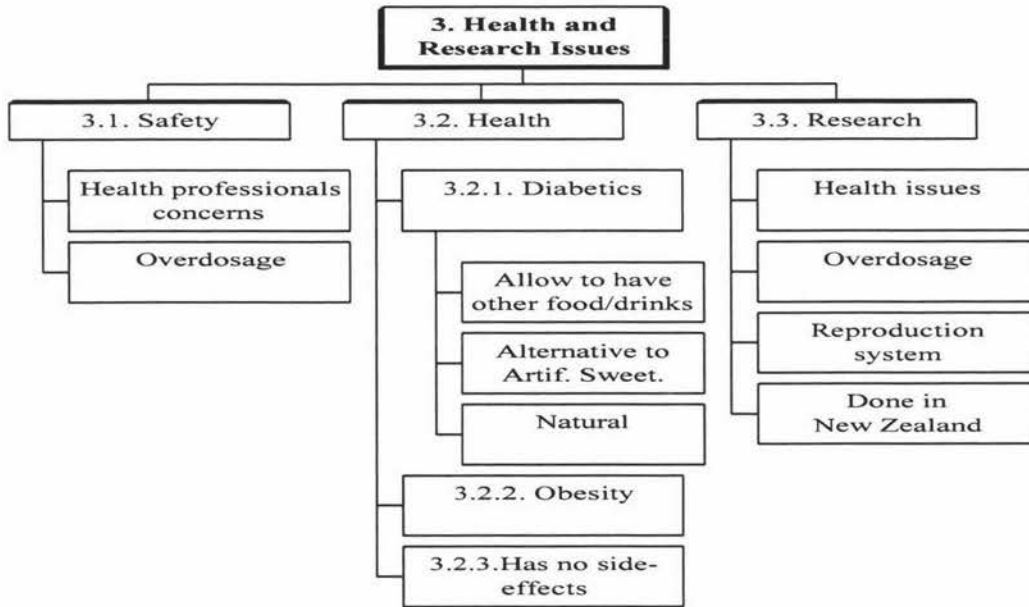
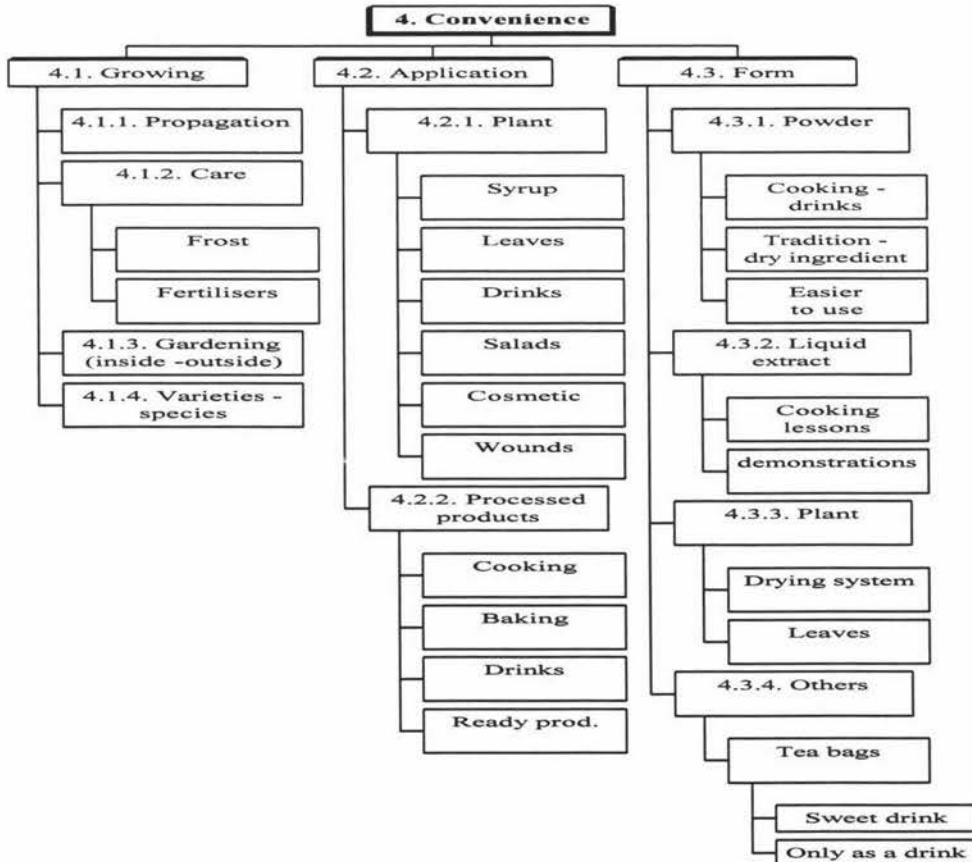


Figure A.12. Diabetics' Convenience chart



APPENDIX 10

Maori charts

Figure A.13. Maori's Sensory Evaluation chart

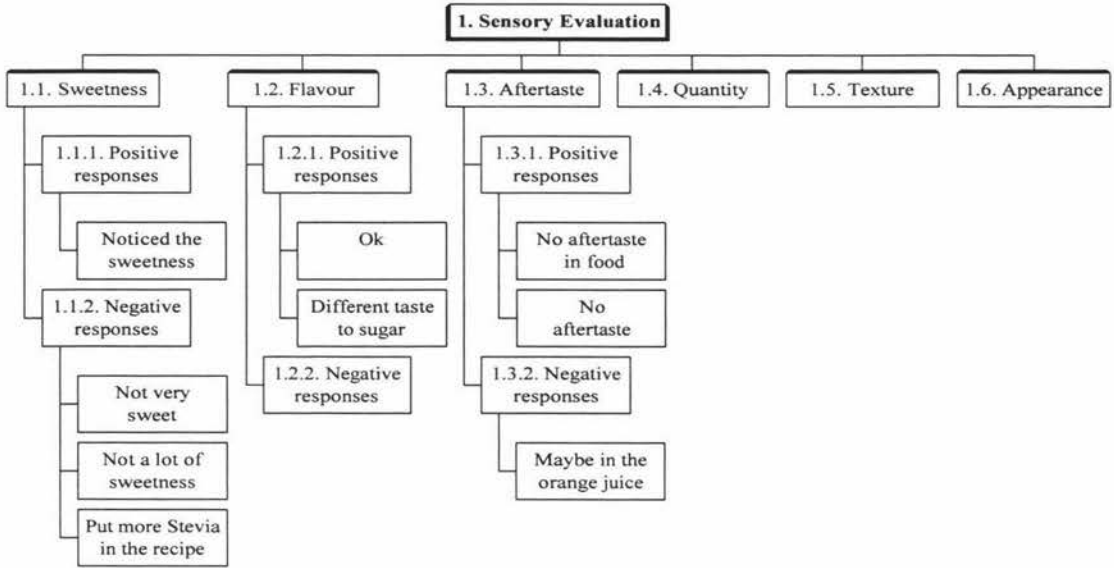


Figure A.14. Maori's Market Issues chart

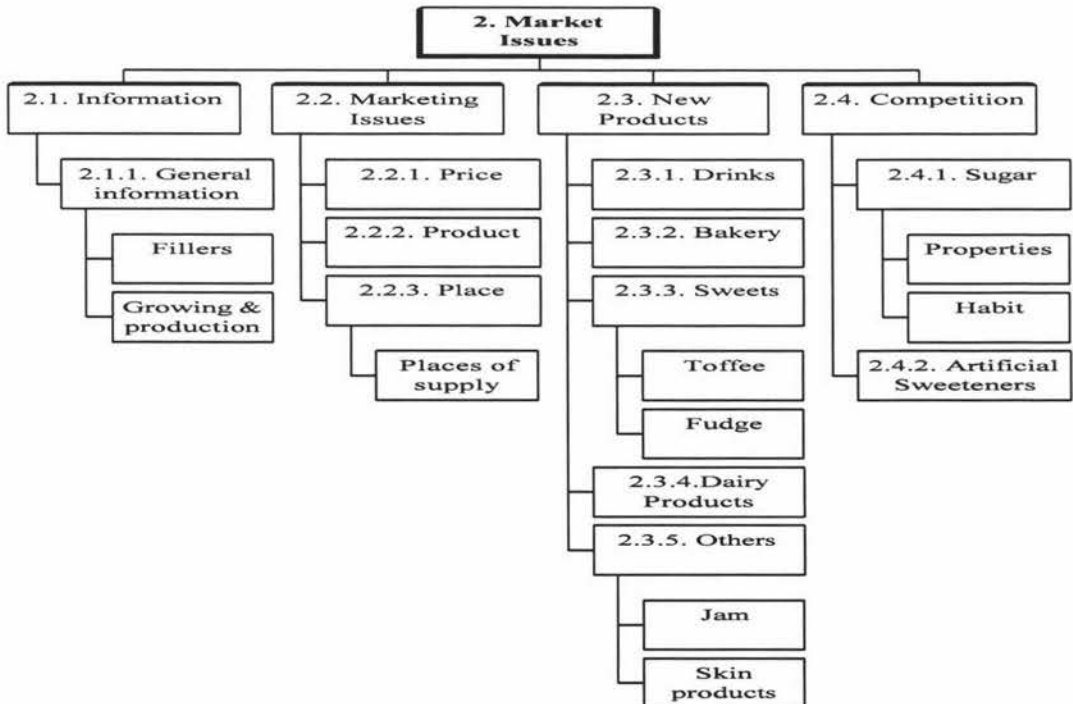


Figure A.15. Maori's Health and Research Issues chart

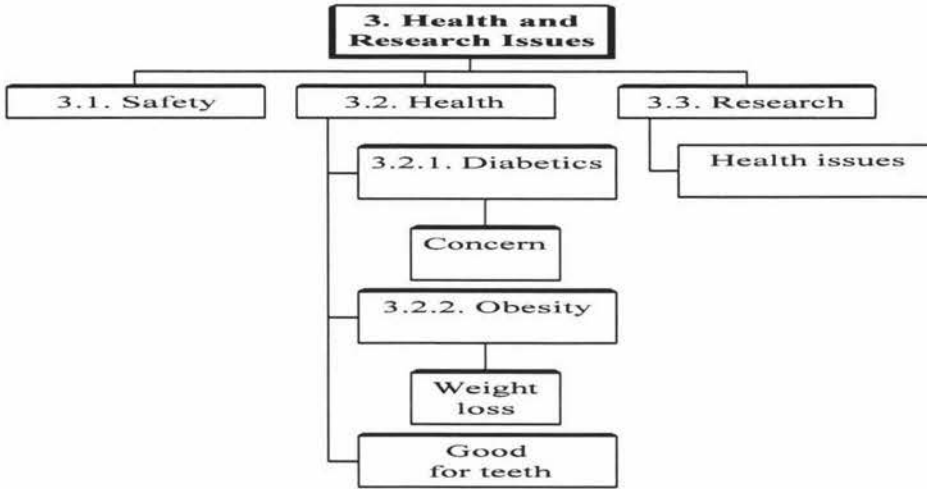
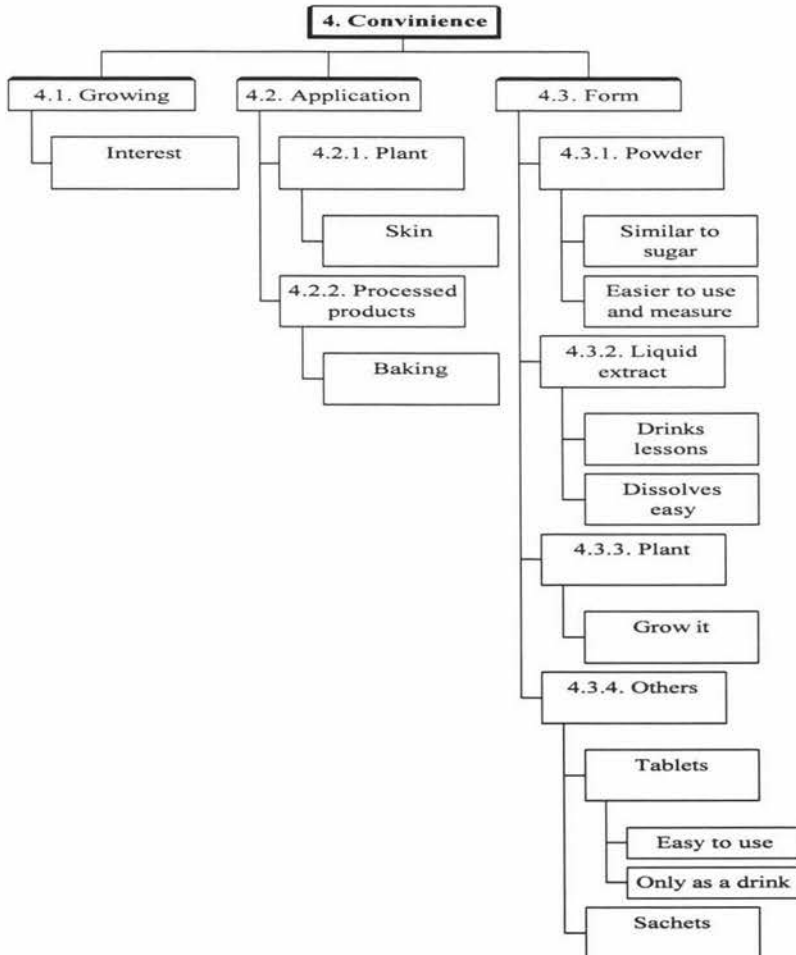


Figure A.16. Maori's Convenience chart



APPENDIX 11

Table A.5. Gender distribution of the groups

Gender	General Public	Herb experts	Diabetics	Maori
1- Female	4	5	7	3
2- Male	2	1	1	4
Missing	0	0	0	0
Total	6	6	8	7

Table A.6. Age distribution of the groups

Age group	General Public	Herb experts	Diabetics	Maori
1) <18	1	0	0	0
2) 19-25	0	0	0	3
3) 26-35	1	0	0	2
4) 36-50	2	3	0	0
5) >50	2	3	8	2
Missing	0	0	0	0
Total	6	6	8	7

Table A.7. Ethnicity distribution of the groups

Ethnic group	General Public	Herb experts	Diabetics	Maori
1) Caucasian	5	4	8	0
2) Maori	0	1	0	7
3) Latin	1	1	0	0
4) Others	0	0	0	0
Missing	0	0	0	0
Total	6	6	8	7

Table A.8. Sweetening habits of all groups

Do you like sweetening?	Extremely	Very strongly	Strongly	Moderately	Indifferent	No	Did not answer
General Public	0	1	1	4	0	0	0
Herb experts	1	0	0	5	0	0	0
Diabetics	0	0	0	6	2	0	0
Maori	0	1	1	5	0	0	0

Table A.9. Sweeteners used by the participants of the groups

What sweeteners do you use in beverages?	Sugar	Sugar Substitutes	Sugar and sug.substit.	None	Did not answer
General Public	1	1	3	1	0
Herb experts	4	1	0	1	0
Diabetics	1	3	2	1	1
Maori	6	0	0	0	1