CONSUMER INPUT AND PRODUCT CONCEPT TESTING IN DEVELOPING DRIED FRUIT SNACK PROTOTYPE FOR MALAYSIAN MARKET

Thesis presented in partial fulfilment of the requirement for the degree of Master of Technology in Product Development at Massey University New Zealand

AIDA HAMIMI IBRAHIM

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Dedicated to my beloved:

parents,

Haji Ibrahim Omar and Hajjah Zakiyatum Nizam M. Samin

and sister, Nurul 'Ain Ibrahim

ABSTRACT

The input of the consumer when developing a dried snack fruit for the Malaysian market using the product development process was studied. A consumer panel made up of Malaysian students was used in each step of the product development process in this study.

Preliminary consumer research was carried out using the focus group and the survey method. The results indicated that the two ethnic groups, Malay and Chinese, within the Malaysian student community could be treated as a homogenous group as they had similar attitude and behaviour characteristics towards the dried snack fruit product . Both student groups had been studying in New Zealand for less than two years.

In the idea generation stage, the consumer panel generated 41 product ideas for the dried snack fruit using the nominal group technique. The 41 product ideas were reduced to three using a series of scoring techniques for screening. At this stage, consumer input was used to determine the market acceptability of the three possible products.

These three product ideas with a benchmark were tested in concept product testing using the target consumer panel to evaluate consumer acceptability. Two different forms, concept description and concept prototypes, of concept testing using two different techniques, the focus group technique and the survey method, were tested in order to determine any significant effects they had on consumer acceptability. It was found that the concept prototypes had a significant effect on the consumers' preferences for product concept appearance, attractiveness and, buying intention. The two different techniques however, did not have a significant effect on the consumer acceptability of the product concepts. Of the two techniques, the focus

group required less time for data collection compared to the survey technique, but the focus group was more expensive to run.

By using the ECHIP programme and the line scale with floating ideals, which was the input of the consumers in the sensory evaluation stage, an optimum product formulation for the dried fruit snack was obtained. The prototype consisted of six types of fruit namely, apple (0.25), kiwifruit (0.25), banana (0.175), pineapple (0.13) strawberry (0.125) and jackfruit (0.07) with their natural flavours. The prototype was tested on the target consumer using in- house tests in order to determine the acceptability potential of the prototype. The results showed that the idea of developing the dried fruit snack with their natural flavours was acceptable among the Malaysian students. Freeze drying was found to be the most preferred drying process for the dried snack fruit product. The acceptable package size of the product by consumer panel was 40gm.

Consumer input played a major role in the product development process in this project and it gave direction in the development of the dried snack fruit product for the Malaysian market. Consumer input was found to be vital during the preliminary consumer research, idea generation, concept testing, product formulation stages, and the final product testing phase in this study.

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CHAPTER 1
INTRODUCTION.

1.1. PRODUCT DEVELOPMENT PROCESS.

The process where an idea is turned into a marketable item is called product development (Challis, 1990). Product development is an industrial research to develop products and processes satisfying a known or suspected consumer need (Earle, 1993). As consumer needs always change with time, products need to be improved to meet these needs, hence the importance of the new product development process (Uaphithak, 1994)

The product development process involves the application of a number of different techniques: consumer and market research, processing development, product formulation, engineering and marketing, developing new product or to improve product already on the market (Uaphitak, 1994).

Generally, product development process is divided by several stages, as described by Earle (1985). At every stage of the model, the cost and other estimates are made to indicate whether it is profitable to go on with the project (Figure 1.1).

This process was referred throughout this project. However, this study does not involve the whole process of the product development. It emphasised mainly on testing the product concept through different forms (product concept statement and product concept prototypes), and different techniques (focus group and

survey method) in order to develop a prototype snack food product based on dried fruit and vegetable which is acceptable for the Malaysian market.

Figure 1.1: Product Development Process (Earle, 1985)

1.2. CONSUMER INPUT IN THE PRODUCT DEVELOPMENT PROCESS.

As the ultimate goal of product development is to create products which have high consumer acceptance, the input of the consumer in the product development process has become very important. Traditionally, there were three stages where consumer input was incorporated into the food product development process. These were firstly, market research, secondly, the sensory testing and finally, the market test (Wan, 1987).

Today, consumer panels are used throughout the full course of the product development process for many different purposes such as defining the important product characteristics at the start of product development, and testing the products developed to determine the acceptability of the various characteristics (Table 1.1).

Consumer input in this project has been used in: preliminary consumer research (focus group), consumer research (survey method), idea generation (nominal group technique), screening, product concept testing (focus group, survey method), product formulation (central location test), and final product testing (in home test).

The size of the panels range from 42-150 consumers (Wan, 1987). In this study, the small size of panels, between 6-64 consumers were used since there was a limited number of Malaysian students studying at Massey University.

In selecting the consumer panel in food product development, it depends on the type of product being tested and the market commercial for that product. Moreover, it is important that the panelist used in development of the particular product are representative of the people in market and are also must be regular

users of the product type (Earle, 1995). For the purpose of this study, Malaysian students who studying at Massey University for less than two years were selected as they were represented the target population in the market.

Table 1.1. : The consumer input in the product development.

Product Idea Generation	6-8 consumers	
Product Idea Screening	6-8 consumers	
Product Formulation		
-initial stage	6-8 consumers	Increasing important number of panelists for drawing right conclusions and making right decisions
-later testing	10-15 consumers	
Pilot Plant Trials		
-initial testing	10-15 consumers	
-later testing	30-50 consumer	
Package development		
-idea generation	6-8 consumers	
-package testing	30-50 consumers	
Production Trials		Increasing consumers penalty for wrong decision
-testing	50-100	
Final product testing		
consumer testing	200-300 consumers (representative of market segment) central location test. In-home test.	Increasing panel size.

Source: Wan, 1987.

1.3. **PRODUCT CONCEPT TESTING.**

In the product development process, concept testing is undoubtedly as one of the most important step beside idea generation, development and commercialisation as concept testing represents a pre-test marketing stage in a product's evolutionary process (Goulding, 1983)

Once a new product idea has been identified in the idea stage as having potential, it should be further developed and screened through interaction with potential consumer to determine consumer acceptance without necessarily involving any cost of the manufacturing process. The objective of concept testing is to determine the consumer interest in the basic idea of the product and to indicate whether the product ideas should be developed further (Hisrich and Peter, 1991).

Before a concept can be tested it must be expressed in some format which can be presented to respondents such as written statement or actual "mock-ups" of the product (prototypes). There are different points of view regarding to the development of the product concept.

Some believe that the concept statement should be simple and factual (Iuso, 1975). While others believe that the advantages of a more finished concept far outweigh the risk (Sherak,1966; Kotler, 1984). The argument was based on that the reliability of the concept test increases as the stimulus becomes more concrete and physical (Kotler,1984).

However, Tauber (1972) reported that although the higher ratings were given to visually rather than orally described concept, the ranked order of concepts was the same in both methods. There is a lack of evidence to establish which form of

concept communication and presentation is best within the testing environment (Chapman, 1988).

In this study, two different forms of product concept were tested: product concept statement and product concept prototype, in order to determine any significant effect of product concept prototype on panelists acceptability and preference toward the product concept.

Beside, establishing the form of concept communication, it also fundamental in concept testing to establish the testing technique. White (1973), and Iuso (1975) have used focus group technique in concept testing as they believes that it will produce a wider range of responses and will provide an indication of market reaction to an idea. Sherak (1966), on the other hand, introduced a more quantitative form of concept testing to determine how many consumers are favourably disposed toward a new product.

Since there is a lack of evidence in selecting which techniques of concept testing are best for snack food products, the present study was conducted to indicate any differences between the focus group and survey method in testing the product concept.

1.4. MARKET INFORMATION OF SNACK FOOD IN MALAYSIA

There are no published statistics on the size of the Malaysian snack food market, but industry experts valued the market for extruded snacks, roasted nuts and potato chips in 1990 at US$84.1 million. This encompasses both local and foreign snacks (Anonymous, 1992).

In a study done on general snacking habits of the Malaysians showed that 95.4% (92.5% was Malay and 98.2% was Chinese) of the respondents snacked between meal (Wan, 1987). Therefore, this indicate that snacking is common practice in the Malaysia society

To indicate the types of snacks eaten Wan (1987) has divided the types of snack into seven categories namely, hawker food, bakery snacks, kuih, biscuits, puffed/extruded snacks, nuts, and fresh fruit. It was found that the most popular types of snacks among the respondents were hawker food, and bakery snacks, followed by biscuits and "kuih". The dried snack fruit product which will be developed in this study however, was not included in his study.

Two students conducted a survey on snack food products in three supermarkets around Kuala Lumpur to indicate the market potential of the dried fruit snack product in Malaysia. The results showed that 43% of the snack food products available in the three supermarkets were dried snack fruit, followed by extruded snack food (30%) (Figure 1.2)

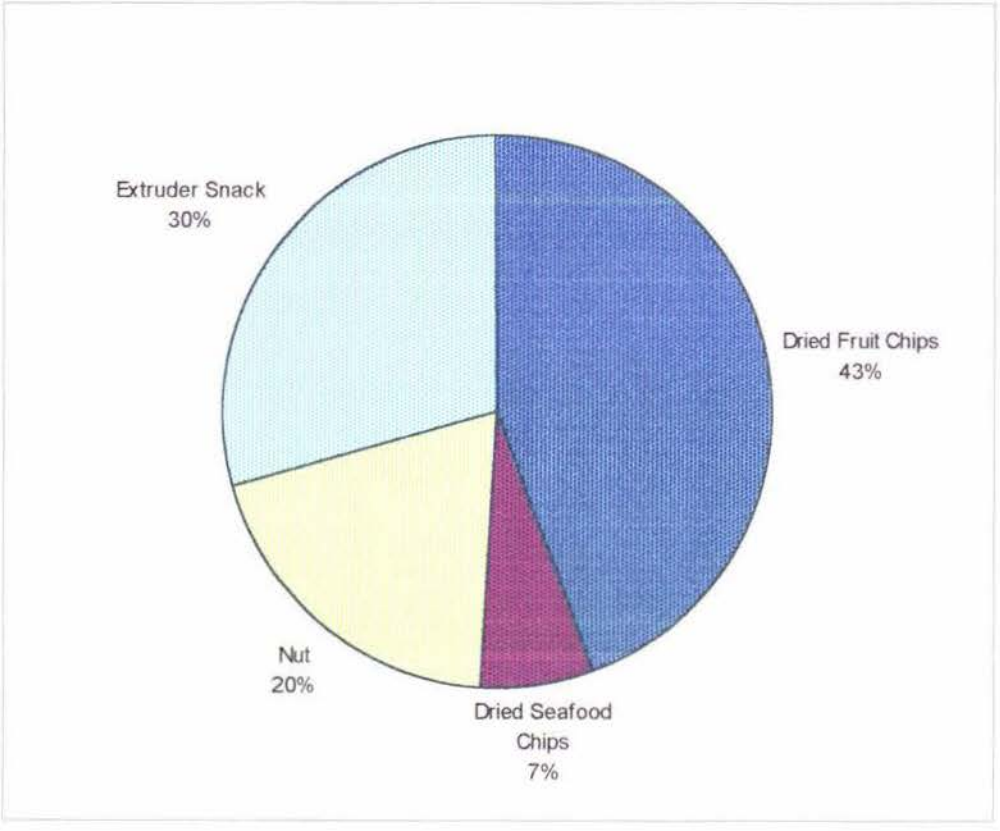


Figure 1.2: The snack food product available in three supermarkets in Kuala Lumpur.

This survey showed that the dried snack fruit product shares large share of the Malaysian market. This survey also indicated that the majority of the dried snack fruit product available in these three supermarkets were sold between the price of $1.00 to $1.50 (Figure 1.3). The detailed information of this survey is shown in Appendix 1.1.

Based on the information from the survey, the dried snack fruit product in this study was chosen to be developed for the Malaysian market.

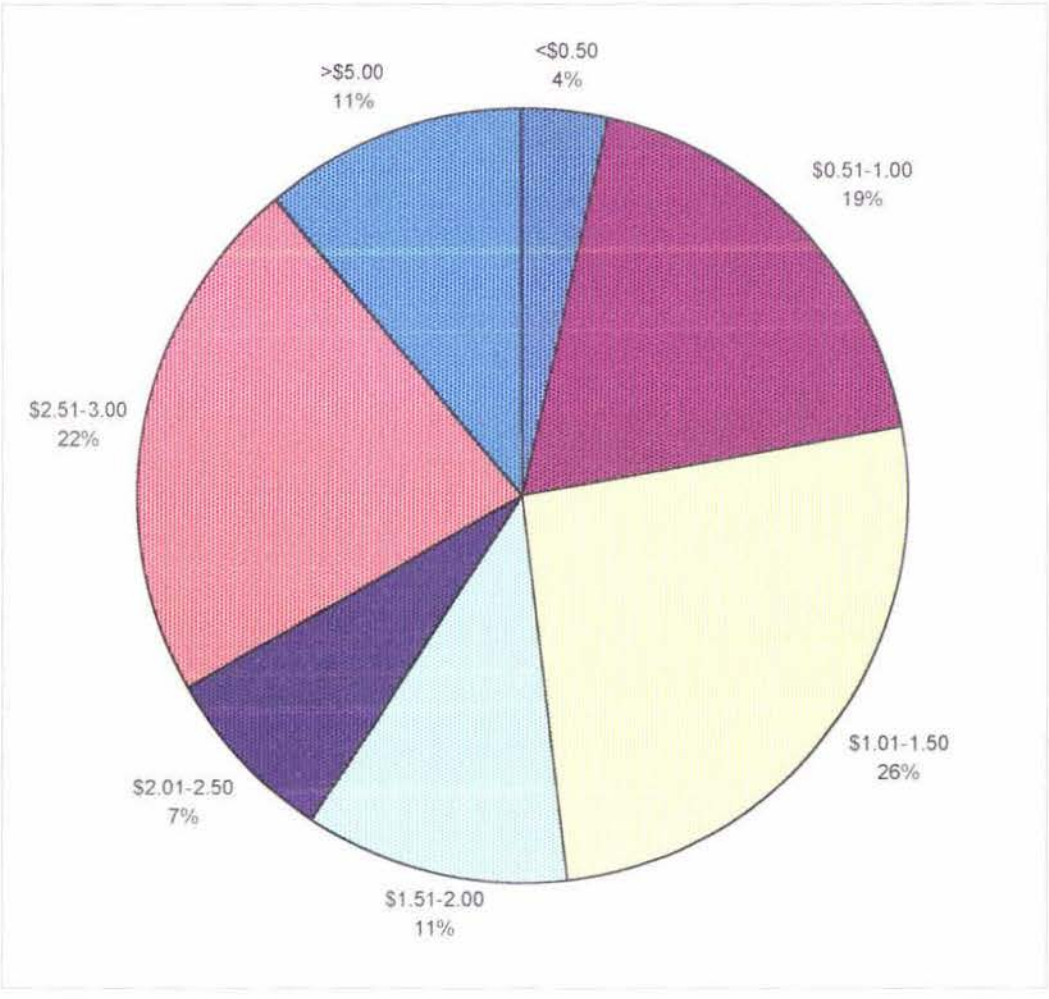


Figure 1.3: Market price of snack food product available in the three supermarkets in Kuala Lumpur.

1.5. THE PROJECT AIM, OBJECTIVES AND CONSTRAINTS.

The aim of this project was to develop a snack food acceptable to the Malaysian market based on dried fruit and vegetables. The objectives were:

* To determine the preferred attributes of a dried snack food product among the Malaysian students at Massey University.
* To determine an acceptable flavouring for the snack food product based of dried fruit and vegetable.
* To establish an optimum formulation of the dried snack fruit product for Malaysian market.

* To compare two different techniques (focus group and survey method) and forms (product concept description and product concept prototypes) of product concept testing for the evaluation of product acceptability among the Malaysia students at Massey University.
* To produce the product packaging design for the dried snack fruit.
* To optimise the final product using Malaysian students at Massey University.

The project constraints were:

a) Product constraints.

* The stability of the product at room temperature.
* The product must be available with a variety of fruit and vegetable.
* Packaging single serve of 40-80gm. net.

b) Processing constraint.

Utilisation of existing equipment at the Pilot Plant Laboratory at Department of Food Technology, Massey University.

c) Market constraint.

Product price per unit should compare with competitive product on the Malaysian market.

CHAPTER 2.
LITERATURE REVIEW

This chapter review the process of the product development as described in the literature and also describes the techniques used in this project. These included consumer study, product ideas generation, product concept testing, freeze drying, and product testing.

2.1 PRODUCT DEVELOPMENT PROCESS.

The last twenty years have witnessed significant advances in the sophistication of product development model. Many organisations organise their new product development process into an orderly sequence of steps, starting with idea generation and ending with commercialisation. The systematic approach of the product development process, stated by Booz, Allen and Hamilton in 1982, the seven stages of product evaluation, is widely utilized and cited by various organisation.

The seven stages of product evaluation consist of new product strategy development, idea and concept generation, screening and evaluation, business analysis, product development, testing and commercialisation. According to Booz, Allen and Hamilton (1982), the core steps of new product development process are new product strategy development, idea and concept generation and business analysis as these steps a provide framework for the product development project.

2.1.1 New Product Strategy Development.

Development of the new product strategy is the foundation for the new product management as it set the direction of a project and clear definition of the product will lessen difficulties during the project. The main purpose of developing a new product strategy is to establish the strategy project requirements that the new product should satisfy (Booz, Allen and Hamilton, 1982).

Developing a well-defined strategic role for a new product involves an in-depth understanding of consumer problems, the internal capabilities of organisation, the requirements to be placed on new products, and the fit of the new product effort within the organisation unit strategy (Booz, Allen and Hamilton, 1982).

It is important for the organisation to know the strengths and weakness of the organisation in setting up the new product strategy because by knowing the core competencies of the organisation, the organisation has a clear start for searching the new product definition (Crawford, 1994). The overall organisation strengths and weakness should be assessed on the specific factors such as marketing, technology, production and finance (Hisrich and Peters, 1992).

There are four major steps in developing a new product strategy as stated by Kotler and Armstrong (1991). These are defining the organisation's mission, setting organisation objectives and goals, designing project portfolio, and planning marketing. As a whole, the new product strategies are developed to achieve the objectives that guide the product planning and development process from idea generation to commercialisation.

2.1.2. **Idea and Concept Generation.**

The search of new product ideas should be systematic rather than haphazard, as this is such a crucial area in product development process (Kotler and Amstrong, 1991). At this stage, well-defined objectives and strategy planning is important as it provides a framework of searching new product ideas.

The two surveys done by Booz, Allen and Hamilton in 1968 and 1981, indicate that there had been a decrease in the number of ideas generated to produce a successful new product. In 1968, it took fifty-eight new product ideas to generate one successful new product. However, in 1981, the organisation is able to turn out of seven ideas into the successful new product.

On the contrary, Wind (1982), Rochford (1991), and Earle (1985) found that the probability a new product developments system will lead to a successful product entry depends to a large extent on the number of new product ideas generated at the start of the process. The most important thing in generating the new product ideas is a well-defined of the new product development strategy that the organisation should state which products and market to emphasise so it can fit to the organisation mission (Kotler and Armstrong, 1991).

Idea generation has been classified in various way such as by Mathot (1982), classified idea generation into three techniques such as systematic analytical techniques for example morphology analysis, associative techniques, such as brainstorming and analogical techniques, such as synetics.

Wind (1982), classified idea generation techniques into two group such as unstructured approach, for example brainstorming and structured approach, such as problem and opportunity analysis. Meanwhile, Crawford (1994), classified

idea generation technique into two categories, Problem find and solve approaches, it includes market research and brainstorming, and Fortuitous scan approach that includes properties' analysis of existing product such as attribute analysis and technoeconomic design.

There are many different methods for generating new product idea such as brainstorming, focus group, attribute analysis, gap analysis and morphological analysis. Idea generation can be generate by individuals or one of several group methods using either internal or external sources (Rochford, 1991).

The various idea-generation techniques have several limitations. Some require more information, and some are suitable for identification stages of new product. Some techniques are better suited to identification of product modification ideas than to complete new products, and some techniques are more applicable to idea generators with specific functional backgrounds. When deciding on the best technique to use, the new product strategy step is important as it provides a focus for idea-generation so that the ideas generated are developed to meet strategic objectives (Booz, Allen and Hamilton, 1982).

2.1.3. **Screening and Evaluation.**

After developing a list of product ideas, the product ideas need to be screen to determine those with the most potential for further development. Screening and evaluation procedures are a crucial step to overall success of the new product development process, since a failure to eliminate a poor idea may result in unnecessary cost and the diversion of resources from a more promising idea (Wind, 1982).

At this stage, the product idea must be clearly described, and the overall aims and objectives of the organisation must always take dominance over the qualities of a specific product because no matter how brilliant a product idea is, it must be rejected unless it fits with overall organisation policy (Earle, 1985).

According to Earle (1985) and Twiss (1986), screening criterion should be compatible with company objectives and strategies, marketability, manufacturing capability, technical possibility, and financial investment. However, there is a weakness in implementing company strategy and objectives in screening and evaluating product idea, because the truly innovative product idea that does not fit current objectives will be omitted (Wind, 1982).

There are many different techniques for product idea screening such as sequential screening, checklist, project profile and economic evaluation. Numerous models have been proposed by various authors for product idea screening and evaluation such as by Baker (1986); ranking model, scoring model, economic model, and optimization model, and Coper (1981); measurement models, economic models, portfolio selection models, and market research approaches. The choice of screening techniques and criterion factors are differ from company to company, and from product to product.

2.1.4. **Product Concept Testing.**

After a new potential product idea has been identified through the screening step, it should be further developed and refined through interaction with consumers. The product ideas are tested to determine consumer acceptance without necessarily involving the cost of manufacturing the physical product (Kotler and Amstrong, 1991).

According to Page and Rosebaun (1992), the purpose of product concept testing is to evaluate consumer market acceptance toward a proposed new product before any money and time is spent on further development.

Through testing the product concept, any major deficiencies in the product idea can be discovered. From here, research and development can be better directed to develop more a marketable product, or the concept can be dropped from further consideration (Graf and Saguy, 1991).

However, there are limitations in using the product concept as indicator of consumer market acceptance, because it can be difficult to get a valid response to the concept. Concept testing can provide an approximation of interest of the target market that allows management to select new product ideas with the most potential for further development (Page and Rosebaun, 1992).

The most crucial stage in concept testing is presenting a product concept in a form in which all the information is presented clearly to group of consumers. There are many ways to present a product concept. Either in description or as a prototype.

The choice should be determined by the purpose and the objective of product concept testing (Crawford, 1994). If only a general reaction of new concept are needed, then simple formats are acceptable; but if researcher want to indicate purchase intentions, more complex formats is needed as consumers need to understand the physical appearance of the product in evaluating the product concepts (Crawford, 1991; Page and Rosenbaun, 1992).

After the product concept is developed, it is shown to an appropriate group of target consumers, such as in-focus groups, mini groups, or triads, in group

interviews or one-on-one to get consumers' reactions. At this stage, research techniques such as telephone interviews, street intercept interviews, or mail panels can also be used (Crawford, 1994).

There are four important elements in evaluating consumer interest in a product concept. These are desirability, or the degree to which the product solves a problem, uniqueness, believability, or the degree of convicing consumer that the product can do what it says it can do, and buying intention (Crawford, 1994; Page and Rosenbaun, 1992).

2.1.5. **Economic Evaluation.**

Once the screening of product concept ideas is complete, the process of economic evaluation is attempted. The purpose of implementing the economic evaluation stage is to improved financial evaluation of the new project and increase the effectiveness of research and development investment (Twiss, 1986). To ensure effective use of resources and to identify the factors of financial success, the strategy plan of the company should put forward as a guide line (Booz, Allen and Hamilton, 1982; Pearson, 1986, Kotler and Armstrong, 1991). During this stage, estimation of raw material cost, together with processing requirement and costs should be available.

In evaluating the favorability of a new project the evidence from previous studies shows that forecasts tend to be optimistic, and the greater the technological advancement, the larger underestimation occur (Twiss, 1986). Twiss (1986), also stated that it is difficult to estimate the benefit:cost equation since the sales forecasts must anticipate the buying response of consumer several years ahead in

the absence of specific price and performance information, while at the same time, not knowing what competitive product will be available.

To overcome the uncertainty of economic evaluation, there are various economic analysis techniques that can be used for project selection and analysis of cost effectiveness, such as discount cash flows for example net present value and internal return rate, pay-back period, and profitability index. According to Campley et. al. (1994), net present value and internal return rate methods are the most preferable methods as they assess all cash flow throughout the project, and take into account the time-money value where a dollar today may be worth 65 cents tomorrow.

The usefulness of the techniques is dependent upon the validity of the data to which they are applied (Twiss, 1986). The information gathered may be mislead by unmeasurable factors, such as short-term bias and personal attitudes. however, these factors can be minimised by asking estimate from senior management and using historical data from earlier project (Pearson, 1986; Twiss 1986).

An equally important factor in economic evaluation is risk analysis. It is advisable to reject a high risk project, in spite of a high expected payoff from it, because it may cause escalation on development costs to a figure beyond the company's financial availability (Twiss, 1986). Even though risk analysis only provides a rough pictorial representation, it enables the company to compare and select projects consistent with corporate strategy and objectives (Twiss, 1986).

The success of new product will depend upon producing a product which can be sold more cheaply than the existing product or with a superior performance. Throughout the economic evaluation, new product ideas can be compared, and the project with the most potential is selected for further development.

2.1.6. **Prototype Development.**

After the product passes the economic evaluation, the next step is to turn the product concept into a physical product. At this stage, a product brief and preliminary product specification are formed. At the early stage of product development, product formulation, processing requirement, and total cost approximations are outlined. These allow the development of the new product to be more productive and specific (Ed Neff, 1985). At the same time, legal regulations should be considered, because they affect all aspects of a product's design from the ingredients, package design, and labelling requirements to trade and registration requirements (Wind,1982).

A product prototype is develop in which raw materials, product formulation, processing conditions, and approximate costing need to be investigated. This is closely followed by detailed product specification and the outline of the process-flow operation (Ed Neff, 1985). According to Kotler and Amstrong (1991), in designing the prototype product, developers must insure that the design not only satisfies consumer need, but can produced speedily and at the budgeted cost.

When the product prototypes are ready, they must be tested. At this stage, future buyers and users should be brought to use and test the variations of the product, because it is inexpensive to do modification at prototype development stage (Earle, 1985). After the prototype product is ready and capable of being reproduced, the design is then passed to the manufacturing area to confirm the manufacturing capability of the product. During this stage, the prototype product is processed under manufacturing conditions, and any deviations in product quality are identified and adjusted (Meyer, 1984).

At this stage, the experimental steps studying the processing parameters are completed, either on pilot plant, or using small runs on the standard plant. The purpose of this stage is to find if the product can made easily, consistently, and economically to the quality standard of the manufacture (Earle, 1985). At the same time, a sufficient quantity of the product is produced for consumer testing and evaluation. There may also be an opportunity for testing product storage life to find if the product can withstand the expected storage conditions.

2.1.7. **Product Testing.**

After the product formulation and manufacturing processes have been completed the next stage is product testing, in which the new product goes through an evaluation process toward commercialisation. According to Wind (1982), product testing can serve as a pilot operation aimed at locating unanticipated problem in the marketing of the new product. The basic purpose of test marketing is to test the product itself in the real marketing situation (Kotler and Amstrong, 1991).

The product testing involves a sample of target customers trying the product under normal conditions. At this stage, there are factors which should be considered, such as the method of distribution, the product, the method of obtaining information on the product, the information needed, test location, and the timing of the test (Wind, 1982).

In product testing, valuable information is gathered on potential product sales, volume degree of consumer preference, package design, and repeat purchase (Kotler and Amstrong, 1991; Hisrich and Peters, 1991; Cafarelli, 1980). After this information is analysed, the product can proceed to the commercialisation stage.

However, there are limitations in using product testing as product market potential assessment; the information that is gathered does not insure successful new product introduction, because it does not involve a purchase decision by the consumer. Furthermore, it does not evaluate some of the other critical elements of the marketing mix that significantly affect the successful introduction of new product (Hisrich and Peters, 1991).

2.1.8. **Commercialisation.**

Product commercialisation involves the full scale production and marketing of the product with the significant commitment of the firm. According to Kotler and Amstrong (1991), there are four factors to be considered before launching.

The goals of product commercialisation are to inform consumers of the new product and get them try it (Kotler and Amstrong, 1991). Promotion strategy during introduction is crucial, because during this stage, the consumers are informed about the new product and how it can satisfy their need. By getting the new product in the consumer's hand, a company may then encourage repeat use and adoption (Hisrich and Peters, 1991).

There is a time factor concerning when is the right time to introduce the new product, whether to launch the new product in a single location or internationally, to whom the company must target its distribution, and how the new product will be introduced to the market.

The most effective way of achieving product commercialisation is to create a marketing plan and production plan successfully, because it is important for product introduction to be timed with product distribution. According to Earle

(1985), the product should be available on the market at the time of the advertising campaign; if it is not, the potential sales of the product can be lost.

Furthermore, timing strategy of product introduction is also important. The firm should decide whether they want to be pioneer in the market and to be aggressive in its marketing program, or to be a later follower in the market and capitalise on the gaps or weaknesses of competitors. All this will be directly related to mission of the firm, the resources available, and the competitive environment (Hisrich and Peters, 1991).

Product liability and defects should also be considered during the product introduction. Hisrich and Peters (1991) stated that the company should try to minimise these problems before launching, by establishing an effective response procedure such as the continuos research of consumer usage. Once the product is launched and sales are in line with predictions, research and development work should be continued in an effort to support and increase product sales.

2.2 PRODUCT DEVELOPMENT TECHNIQUES USED IN THIS PROJECT

In this study, there is a certain techniques was used to fulfil the aim and objectives of this project such as consumer study in product development, nominal group technique in idea generation, techniques of concept testing, freeze drying of fruit, and scaling method in product testing. All of this techniques will be discuss in this section.

2.2.1. **Consumer Survey.**

Zikmund (1982) has defined the consumer survey research as a method of data collection based on communication with a representative sample of individuals either by using verbal or written questioning. From the consumer survey, consumer reactions towards existing product on the market and the products which are new to the market can be discovered (Uaphithak, 1994).

The advantages of conducting the consumer survey in market study are; it is quick, inexpensive than observational or experimental research, efficient and accurate means of assessing information about the population (Zikmund, 1982). Furthermore, through consumer survey many different kinds of information in many different marketing situations can be obtained (Kotler and Amstrong, 1991).

In spite of these advantages, consumer surveys also have the limitations. The information's that will be obtained from the survey are biased by methods of sampling, techniques of sample presentation, amount and type of instruction provided, and the construction of the questionnaire (Pangborn, 1965). Moreover, in consumer survey, it is impossible to duplicate market condition, so responses are not obtained under normal buying conditions (Pangborn, 1965).

These disadvantages can be overcome by selecting a suitable survey method, target consumers and the questions to be presented to the consumer for a specific product (Uaphithak, 1994). There are four main elements which are requires in collecting an accurate and relevant data in consumer survey; the objective of the survey, sampling plan, contact methods, and research instruments (Kotler and Armstrong, 1991).

The objective of the survey gave a direction to the researcher in order to obtain the relevant data for the project. In this study, the objective of the consumer survey was to get information about consumer attitudes and behaviour towards the existing products and the attributes of a proposed product.

In the consumer survey, the information is drawn through studying a small group of people who represent the population of the target consumer. Since this group of people acts as the sample of the population, it is important for researcher to carefully determine the sampling plan (Kotler and Armstrong,1991). Kotler and Armstrong (1991) suggested that three elements requires to be considered in designing the sampling plan: sample unit, sample size, and sample procedure.

First, sample unit is the group of people who are selected to represent the target population. Second, sample size is the number of target group which represent the population of the target consumer. Third, sample procedure in which the target group in the sample is chosen. Two types of sample procedure is used in consumer survey; probability sampling and non-probability sampling (Zikmund, 1982; Kotler and Amstrong, 1991; Earle, 1995) (Table 2.1).

Quota sampling was chosen in this study, in order to obtain representation of both ethnic groups (Malay and Chinese) of Malaysian students who have been study in New Zealand for less than two years, and at age between 20 to 30 years old.

Table 2.1: The types of sample procedures.

Probability sample.	
a) Random sample	Every member of the population has a known and equal chance of selection .
b) Stratified sample	The population is divided into mutually exclusive groups (such as age groups), and random samples are drawn from each group.
c) Cluster sample	The population is divided into mutually exclusive groups (such as blocks), and the researcher draws a sample of the groups to interview.
Nonprobability sample	
a) Convince sample	The researcher selects the easiest population members from which to obtain information
b) Judgement sample	The researcher uses his /her judgement to select population members who are good prospects for accurate information.
c) Quota sample	The researcher finds and interviews a prescribed number of people in each of several categories.

Source: Kotler and Armstrong, 1991.

In the consumer survey the information can be obtained through three different methods; telephone, mail, and personal interview (Zikmund, 1982; Kotler and Amstrong, 1991; Earle, 1995). The advantages and disadvantages of each contacts methods are showed in Table 2.2:

Based on the advantages of personal interview on flexibility, quantity of data collected, speed of data collection and response rate, this method was chosen in this study. There were two techniques of personal interviews used in this study; the focus group (unstructured interview) as a preliminary consumer research and survey method (structured interview).

Table 2.2: The advantages and disadvantages of contact methods.

	Telephone	Mail	Personal
Flexibility	Good	Poor	Excellent
Quantity of data that can be collected	Fair	Good	Excellent
Control of interviewer effects.	Fair	Excellent	Poor
Control of sample	Excellent	Fair	Fair
Speed of data collection	Excellent	Poor	Good
Response rate	Good	Poor	Good
Cost	Fair	Good	Poor

Source: Kotler and Amstrong, 1991.

After determining the right sampling plan which representative the target population and the right contact method, the researcher should determined an appropriate research instrument to ensure the accurate and reliable data is obtained.

There are two types of research instruments in consumer survey; questionnaire and mechanical instruments. The most common research instruments in consumer survey is questionnaire (Kotler and Amstrong,1991).

Four factors are require in preparing the questionnaire; first, what information should be collected, second, the form of the questions, third, the wording of the questions and finally, the ordering of the questions (Kotler and Amstrong, 1991). Two types of questionnaire generally used in consumer survey; close-end questions, and open-end question. The close-end question included all the possible answers, and respondents make choice among them. The open-end question, on the other hand, allow the respondents to answer the questionnaire using their own word (Zikmund, 1986).

Open-end question are commonly used in the exploratory research in which the researcher is trying to find what people think but not measuring how people many people think in a certain way. Close-end question on the other hand, provide answers that are easier to interpret and tabulate (Kotler and Armstrong, 1991).

For the purposed of this study, both types of questionnaire were used. Open-end question was used in the focus group in order to know what target consumer think about the existing snack food and the attributes of the proposed product. Close-end question was used in order to indicate the differences of attitude and behaviour of two ethics group of Malaysian students toward the dried snack fruit.

The consumer research had been used successfully in product development in order to develop a product (Wan (1987): develop bakery product for Malaysian; Uaphitak (1994): glue stick for Thai).

2.2.2. **The Nominal Technique in Idea Generation.**

Nominal Group Technique (NGT) is a structured brainstorming process which can be used to improve group interaction in problem solving. This technique was first developed by Andre Delhecq and Andrew Van de Ven and is well defined in several stages, limiting problems such as the influence of dominance participants normally occurring in other groups discussion techniques, (Geoff and Ford, 1992).

NGT is particularly useful as an alternative technique that provides a middle ground between the focus group and structured methods when depth of understanding is desired (Claxton et. al., 1980). However, NGT can also be used

for exploratory research as it shares with exploratory focus group the facility for identifying issues relevant to target consumer (Calder et. al., 1975).

NGT has four factors however that distinguishes it from other exploratory methods. Firstly, NGT enables the researcher to identify priorities for each participants in the session. Secondly, the nature of NGT makes it possible to analyse the similarities and differences between NGT sessions. Thirdly, NGT gives an equal opportunity to each participant to give their input and finally, the structure of NGT simplifies the process of training session leaders (Claxton et. al., 1980).

In this project, NGT was used in generating ideas for developing a dried snack fruit product for the Malaysian market. The nature of NGT was well structured, quick and easy for the participants to go through (Wan, 1987). Also, the equal opportunities given to the panelists in NGT overcomes the influence of dominant participants which is always associated with focus group or brainstorming, NGT was the best technique for idea generation in this project.

The NGT is divided into five steps; silent generation, round robin presentation, clarification, ranking, and discussion (Zuech, 1992). Typically, two or three hours are needed for full the NGT session (Fortune, 1992).

Before, the silent generation stage started, the moderator gave the participants a statement of the project purpose as a topic to be discussed. In the silent generation stage, each participant was given 10-15 minutes to reflect individually on the topic and record their personal ideas on the worksheet. This provided an opportunity for the participants to think through their ideas rather than simply react to the comments of others.

These ideas were then elicited from the participants on a round robin basis, and written in order of presentation on the board. This process was to ensure full opportunity for participation of each person. Once all the ideas had been exhausted, the next stage was clarification which involved consolidation and renewal of the complete set of ideas by the moderator and participants. The purpose of the clarification stage was to eliminate duplication and to ensure that all ideas are clearly understood by the participants.

The next stage was ranking, which involved grading the ideas, with the group decision being derived for rank ordering or rating. Through the ranking process, the preliminary screening of the ideas was done. The session was close with a brief discussion of the results of the ranking process. The success of NGT however, depended the ability of the researcher in processing the ideas (Geof and Ford, 1992).

2.2.3. **The Techniques of Concept Testing.**

After generating and screening the idea, an attractive idea must be developed into product concepts, and the concept needs to be tested using a group of target consumers in order to obtain an initial reaction of the idea represented by the concept (Kotler and Amstrong, 1991). In concept testing, the consumer rates the concepts on a scale that measures the consumer's interest, concept uniqueness, and that concept's ability to satisfy specific needs of the consumer (Moskowitz, 1993).

In order to measure the response to a concept, it must be communicated. The most crucial stage in concept testing is deciding which method of communication is the better approach for testing new products. There were two

forms of communication of the product idea used in this study: a written concept description and the concept prototype of the product.

In writing the concept description for use by the consumer panel, five elements were generally essential; product name, consumer benefit, clear product description, the reason for using the product, and product uniqueness (Graf and Saguy, 1991).

In addition, five factors should be considered when developing the concept description for the consumer panel (Colby, 1973). Firstly, the concept description must be brief without any technical terms. Secondly, the benefits of the concept should be state without exaggeration as the concept must be believable and realistic. Thirdly, the statement should start with the product category. Fourth, the concept should be explained in plain consumer language without any superlatives and rapturous words. Finally, the concept description should communicate the product's reason for being which the consumer should be able to recognise as a useful and needed advantage over the existing product.

In developing the prototype for concept testing, it was essential to develop the prototype which was close to product idea concept as it provided a clearer understanding of the product concept capabilities and benefits (Page and Rosebaum,1992). In the food industry, prototypes have been widely used in concept testing such as for cereal products (Colby, 1973; Moskowitz, 1992), beverages (Bloom, 1977), and fruit syrups (Gruenwald, 1985).

In concept testing, the most crucial stage was deciding what media of communication was the better approach for testing the new products. There were different points of view regarding which approach was better in testing the new product concept.

As stated by Chapman (1988), sometimes it is appropriate that the concept testing be conducted with a fully developed prototype of the product as product stimuli is fundamentally important to consumer purchase decision. According to Kotler and Amstrong (1991) the reliability of the product concept testing can be increased by presenting more concrete and physical presentations of the product concept.

However, Iuso (1975) stated that the concept statement would be simple and factual unlike the product stimuli which provide variables to a test which is supposed to provide market evaluation on the core idea of the concept rather than any particular executions of the content.

The studies that have been done by Armstrong and Overton (1971) showed that a brief or comprehensive description had negligible effects on the "intention to purchase decision". Tauber (1972) established that although higher ratings were given to visual rather than oral concept forms, the ranked order of concepts was the same in both methods.

The choice of selecting the most appropriate concept presentation, depends on the purpose of the research (Tauber, 1972; Crawford, 1991). As stated by Tauber (1972), if an initial screening is the objective of concept testing, written factual descriptions will provide the same result as a that of more elaborate and expensive communication device.

Having selected an appropriate communication form, the concept can undergo testing at consumer level. There are two forms of concept testing, the qualitative and the quantitative forms.

In the qualitative form, personal interviews appear to be the most common method of concept evaluation (Crawford,1994). Personal interviews are usually conducted individually but occasionally researchers use focus group situations to develop concept descriptions, because focus groups can bridge the gap between laboratory studies and quantitative consumer studies (Kraft, 1981; Gruenwald, 1988). In developing a suitable concept description using focus groups, a preliminary description has to be given to the participants to know the language of the marketplace which helps make sure the communication is clear (Gruenwald, 1988).

In the focus group session, 8 to 10 people were gathered and led by the moderator throughout the session. The participants were shown a concept description, and asked to express their degree of interest or disinterest in the product, sometimes the prototype was given for tasting on the spot or for home use (Kraft, 1981).

Iuso (1975) strongly believes in concept test rich in qualitative research. He states that a "concept test requires the conduct of rather lengthy conversations with appropriate consumers to act as reliable and complete indicators of market to an idea". According to Crawford, (1994) focus groups are an excellent form of concept testing especially when the researcher wants respondents to think about the concept and react to the comments of the others.

As by Crawford (1991) stated concept testing was usually conducted using individual personal interviews for many purposes. Sherak (1966) has used a survey method in concept testing to determine the number of consumers who are favourably disposed towards a new product. Haley-Gatty (1971) used self-administered questionnaires using 400 females at four shopping complexes to determine whether the form of communication affected respondent rating. Page

and Rosebaum (1992) used face-to-face interviews with 500 females at three different shopping complex's to measure consumers' interests toward Sunbeam steam irons.

The reliability of the information obtained from the concept testing depends on a combination of the concepts' presentation and the testing technique. Two different forms (concept description and concept prototype) and the two techniques (focus group and survey method) of product concept testing were chosen for this project, as both forms and both techniques have been frequently used in food concept testing. However, its has never been tested for its significant effect on consumer acceptability of the product concepts.

2.2.4. **Freeze-Drying of Fruit.**

Today, consumers are no longer content with the seasonal availability and limited natural freshness of fresh produce (Bobcock et. al., 1990). Due to this, the preservation of fruit and vegetables have become increasingly important. Compared with wet preservation, dehydrated fruit and vegetables offer significant advantages as it can be reduced in weight and volume of fruit and vegetable which result in economical transportation and storage (Babcock et. al., 1990).

However, to ensure constant product quality at high levels, colour, aroma and flavour of the dehydrated product must be typical of the fresh product and must not be subject to change (Babcock et.al., 1990). Among the dehydrated products, freeze dried foods were considered having a quality higher than other dehydrated products (Salunkhe et.al., 1991).

In freeze-dried product, about 70% to 90% of original weight of the food may be lost during dehydration and because of the unshrunken structure, freeze-dried food have extremely low bulk density compared to other dehydrated products (Ginnette and Kaufman, 1968).

In freeze drying, the moisture is removed from the product by sublimation, no transfer of liquid occurs from the centre of the mass to the surface. As drying proceeds, the ice layer gradually shrink back toward the centre, leaving empty spaces formally occupied by ice crystals (Somogyi and Luh, 1986).

This prevents shrinking from occurring and, as a result it gives no change in volume or physical arrangement of the solid material which existed before drying. Therefore, this will minimise damage to the product structure and texture and little change in product shape, colour, and appearance (King, 1973; Somogyi and Luh, 1986). Furthermore, the lack of shrinkage gives an internal porosity within the substances with the results of rapid and nearly complete dehydration of the product (King, 1971).

To obtain satisfactory; product texture, retention of volatiles compounds and rehydrability of the finished product, the moisture content in the fruit (80% to 90%) must be completely frozen (Vollink et al., 1968).

For many fruit, the water crystallisation will occur at freezing point, between -50°C and -60°C (Rey, 1960) . At the frozen stage, it is important to ensure that the fruit are sufficiently well frozen for freeze drying because shrinkage and the loss of the volatile compound occurs at a rate proportional to the percentage of the unfrozen water (King, 1971).

According to Vollink et.al., (1968) it is important that the water content be frozen over a sufficiently long period as this will develop large ice crystals and, the sublimed ice crystal will the leave large channelled openings in the fruit and enable quick dehydration by the water (Vollink et.al., 1968).

Slow-freezing, on the other hand, increases the initial dissolved solid content with increased thickness of the eutectic solid or immobilised liquid layers between the pores and as a result, this increases the degree of aroma retention (Thijssen and Rulkens, 1969).

The low processing temperature in the freeze drier minimises the damage of the various heat-sensitive biological compounds such as non-enzymatic browning, protein denaturation, and enzymatic reactions that are associated with other drying methods, and also helps reduce the loss of volatile flavour and aroma (Saravanos and Moyer, 1968; Ginnette and Kaufman, 1968; Salunkhe et.al., 1991).

The various heat-sensitive biological compounds damages can be minimised in freeze drying by lowering the activation energy of water removal rates during the evaporation or sublimation compared to the degradation reaction in the foods (Ardel et. al., 1973). The activation energy of water removal rate in freeze drying is 9 to 12 kcal/gm mole (King, 1968) compared to 30 kcal/gm mole for non-enzymatic browning.

The disadvantages of using freeze-drying as a drying method are that the drying requires a long time period and therefore, is expensive compared to the cost of canning or other dehydration methods. Also for the freeze-dried product special packaging is required so as to avoid oxidation and moisture pickup of the hydroscopic nature of the freeze-dried fruit (Somogyi and Luh, 1986).

2.2.5. **Scaling Methods in Product Testing.**

Scaling methods of measuring or comparing the sensory attributes of food and drinks, and of measuring attitudes or liking, are widely used in industry (Muller, 1977). A scale has been defined as a graded arrangement, used in reporting assessments. It is divided into three categories namely, category scales, unstructured scales and magnitude estimation (Land and Shepherd, 1988). The importance of these categories lies in their efficiency to produce reliable and discriminative data about the attributes being studied (Land and Shepherd, 1988).

Guilford (1954) has listed the advantages of scoring methods over difference test and ranking methods. Firstly, it require less time than other methods, secondly, it's flexible over a wide range of applications, thirdly, it can be used with untrained assessors, and finally, the procedure is much more interesting to the assessor and it produces better judgements of single samples when comparative judgements are made.

Scoring on category scales is the oldest methods in scaling and is used extensively due to its diversity, simplicity, and ease of statistical analysis (Pangborn, 1984). This method is presented by limited number of categories in terms of number, letters or points on a line to express of variation. There was three different point scales of category scale which normally used in food product; 9 point-scale, 7 point-scale and 5 point-scale. The terminology used in category scales was showed in Table 2.3.

According to Land and Shepherd (1988) the increased of numbers of categories will increase the discriminative ability, although the five-category scale was linear than nine-category scale, it is less discriminating. Hedonic scales was used

by Pangborn (1980) to measure the different concentration of sucrose in lemonade

Table 2.3: The terminology used in category scales

9-point-scale	7-point-scale	5-point-scale
Excellent	Excellent	Excellent
Very good	Very good	Good
Good	Good	Fair
Below good, above fair	Medium	Poor
Fair	Poor	Bad
Below fair above good	Very poor	
Poor	Unacceptable	
Very poor		
Extremely poor		

Source: Amerine et al., 1965

Unstructured scale or graphic scale usually has anchors only at the ends and the distance along the line is measured, as shown:

None _____ Extremely

The assessor marks the line at the point he or she feels appropriate and the distance along the line is measured. The position is normally measured to the nearest mm, with the 100mm this would give scores of 0 to 100. Stone et al. (1974) has used unstructured scales in Quantitative Descriptive Analysis which the ratings are made on a 6 inch line with anchors at 0.5 inch from each such as soft-hard, weak-strong. Another graphic unstructured scale is relative-to-ideal rating. Generally, this method has been used for rating simple attributes such as

sweetness (McBride, 1982). It was also found been used successfully for rating more complex attributes (Shepherd and Griffiths, 1987).

The unstructured scale was used in this project due to the advantages of this scale over category scale is that there is no problem about the number of categories included, or the marking of such categories (Land and Shepherd, 1988). These scales has been widely used in industrial application.

Magnitude estimation involve the use of scales in which successive points are in constant ratio to each other. It was first introduced by Stevens (1953) and has been greatly promoted in sensory evaluation of food by Moskowitz (1975). In magnitude estimation, if one stimulus is three times more intense than another the stimuli can be assigned any number in this ratio, such as 1 and 3; 4 and 12- the ratio is constant (Land and Shepherd, 1988). The major advantage of this procedure is that the scale is believed to have ration properties.

Shand et. al., (1985) has compared the used of category scales, unstructured scales and magnitude estimation in rating meat steaks and found more differences between samples with the category scales and least with the unstructured scales, and panelists least preferred using magnitude estimation.

Giovanni and Pangborn (1983) compared ratings on 100-mm lines with magnitude estimation in study sucrose in lemonade and fat in milk and found that the results from the two types of scale were equivalent.

It appeared that line scales were reliable and easy to use (Wan, 1987). Furthermore, line scales have been successfully for product development (Wan, 1987; Wiriyacharee, 1990; Uaphithak, 1994). Based on these reason, line scaling was chosen for the sensory evaluation in this study.

CHAPTER 3
CONSUMER RESEARCH: ATTITUDE AND BEHAVIOUR OF MALAYSIAN STUDENTS TOWARD DRIED SNACK FOOD PRODUCTS.

It was very important to study the attitude and behaviour toward dried snack fruit product of the Malaysian students as up till now no information has been published in this area. For the purpose of this project, two different techniques were used for the consumer research. First, a preliminary consumer study using the focus group technique. This was done to determine the attitudes and behaviour of Malaysian students towards an existing snack food product and their preferred characteristics for the proposed product. The focus group was conducted in New Zealand using Malaysian students studying at Massey University as consumers.

Second, a consumer survey using the survey method was used to indicate the difference of attitude, behaviour and preference characteristics of dried snack fruit product between the two ethnic groups of Malaysian students at Massey University.

3.1. PRELIMINARY CONSUMER STUDY: FOCUS GROUP.

The focus group discussion is perhaps one of the most frequently used forms of qualitative market research. The focus group technique brings together a small number of individuals for an interview which is conducted by a trained moderator. There were two objectives to be obtained from this preliminary consumer study.

They were:

* To determine the attitudes and behaviour of Malaysian students toward existing snack food products.
* To determine the preferred characteristics of the proposed product.

To meet the two objectives of the preliminary consumer study, a focus group technique was carried out using the Malaysian students studying at Massey University.

3.1.1. **Experimental Method.**

A focus group was conducted at the author's house over the weekend. 8 Malaysian students (7 Malay students and 1 Chinese student aged between 20 and 25 years old) were chosen, who has been studying at Massey for less than two years. The session was conducted by the author and recorded on audio cassette

The session was divided into two stages. First, the participants were asked to taste and comment on the existing Malaysian snack food product that was available in Palmerston North that were also sold in Malaysia. The samples were Cheesezel, Cheeseball, Pretzel with salted flavour, Pretzel with sesame seed flavour, Bhuja mix, Planters corn chips, Planters nuts, Manchos with tomato spices flavour and Grain Waves. The description of the samples are shown in Appendix 3.1.

In the second stage, the participants were presented with three mocked-up samples of dried fruits and vegetables. The dried fruit and vegetables that were used in these mocked-up samples were purchased from the supermarket in Palmerston North. Table 3.1 shows the descriptions of the three mock-up samples.

Table 3.1: The description of the three mocked-up samples.

Mock-up sample	Ingredient	Flavour	The type of drying
Dried Vegetables	bean, carrot, corn, peas, pumpkin, tomato (each of the vegetable were presented individually)	Each vegetable with their own flavour	Air dried
Dried Fruit	apple	apple	Freeze dried
Combination of dried fruit and vegetable	apple, bean, carrot, corn, peas	Each vegetable and fruit with their own flavour	Air dried Freeze dried

Before the participants were asked to give an opinion on the proposed product, the concept of the proposed product had been described by the author as a guideline for the proposed product discussion. The discussion was based on three factors: ingredient combination, product flavour and drying process preference.

For the product flavour, the participants were asked to taste the mocked-up samples, and give suggestions for the suitable flavour of the mocked-up samples. The sequence of topics used in the focus group and the concept of proposed product were showed in Table 3.2.

Table 3.2: Sequence of topics used for the focus group discussion.

a). Discussion on the existing product.

Q1. In general, what do you think about the product in front of you?
Q2. Why do you say that the taste of the products here are different from the ones in Malaysia?
Q3. What kind of flavour of snack food product is suitable for the Malaysia market?
Q4. When you say Malaysian taste, could you please describe more about it?
Q5. In general, what do you think about the texture of the product?
Q6. Why don't you like the texture of the extruded product?
Q7. What do think about the packaging?
Q8. Why do you like the laminated packaging compared to the can?
Q9. What kind of things that make packaging appearance look attractive to you?
Q10. When do you usually eat the snack food?

b). Discussion on the proposed product sample.

The concept of the proposed product.

The proposed product is based on the dried fruit and vegetable where the raw material is available in New Zealand. The proposed product will be consist of fruit or vegetables or both and will have a spicy flavour. The proposed product is produce specially for the Malaysian market.

Q1. In general, what is your opinion or the mock-up sample ?
Q2. What do you think of the combination of the mock-up sample ingredients?
Q3. Why do you say that the combination of fruit and vegetables is not suitable?
Q4. In your opinion, which of the ingredients combination in mock-up sample is suitable for the proposed product?
Q5. Do you think the spicy flavour is suitable for all the mock-up samples?
Q6. Why do you say that the spicy flavour is not suitable for the fruit combination?
Q7. What do you think is the best flavour for each of mock-up sample combination?
Q8. Between the air dried sample and freeze dried sample, which one do you prefer?
Q9. Why do you prefer the freeze dried sample?
Q10. Why you don't you like the air dried product sample?
Q11. Is there anything you want to say about the proposed product sample?

3.1.2. Results of the Focus Group Discussion on the Existing Snack Food.

Discussion on each existing product sample was base on flavour, texture, packaging appearance and snacking pattern.

3.1.2.1. Flavour of the Existing Snack Food Product Samples.

The participants found that the flavour of the existing snack food product was slightly different from similar products sold in Malaysia. For example, cheesezel and cheeseballs tasted more cheesy than the ones marketed in Malaysia. The panelists believed that such a cheesy flavour was not suitable for the Malaysian market. The Pretzels and Planters corn chips tasted very mild compared to the Pretzels and Planters corn chips on the Malaysia market. However, the panelists thought that the spicy flavour of Bhuja mix was suitable for Malaysian tastes.

Most of the participants did not like the taste of Manchos (tomato spices), mainly because in their opinion, spicy and fruit flavours did not complement each other very well. In addition, the participants thought that vinegary flavours were not suitable with snack food products because of the sharp and sour taste. Overall, the participants suggested that a spicy or salty flavour would be suitable for a snack food product for the Malaysian market.

3.1.2.2 Texture of Existing Snack Food Product.

"Crunchiness" was a word mentioned frequently by the participants. This showed that the concept of "crunchiness' was important for the participants as one of the characteristics of a snack food. Among the existing snack food product samples, Pretzel and Bhuja mix were the most preferred existing snack food product mainly because of their crunchiness.

Most of the participants did not like the texture of extruded snack food product samples for example Cheesezels and Cheeseballs. The participants thought they did not get much chewing satisfaction by eating such extruded snack products due to their hollow structure. Furthermore, the extruded snack food products gave a tooth packaging problem when they ate the products.

3.1.2.3. **Packaging Appearance of Existing Snack Food Product.**

Most of the participants agreed that laminated aluminium packaging was more suitable for the snack food product than can or plastic. Laminated aluminium packaging looked attractive and easy to be carry. The can packaging like that used for the Planters product, was more suitable for a family as it is less convenient: need space to keep it, and less easy to carry compared to the laminated aluminium packaging. The plastic bag packaging like that used for the Bhuja mix or Manchos tomato spices flavour, did not look as attractive, even though it is a lot easier to carry.

For packaging appearance, most of the participants liked the Cheesezel packaging appearance. This was due to the bright colours on the packaging; blue and yellow, and the simple picture and words that been printed on the package. The participants did not like the packaging appearance of Manchos spicy tomato flavour. This was because it did not have the inner aluminium layer and the packaging and the colour of the packaging was quite dull. In other words, the participants liked the packaging appearance that had bright colours, simple print and made from laminated aluminium that was easy to carry about.

Figure 3.1: The appearance of Cheezel and Munchos Tomato Spices packaging.

3.1.2.4 **Snacking Pattern of the Participants.**

Most of the participants liked to eat snack foods every now and then. According to the participants, they ate snack foods with their friends when socialising or while watching a movie or the T.V. Snack foods were not eaten frequently or between meals or as replacement food for meals. This was because they usually had a heavy meal such as traditional Malaysian dishes like "nasi lemak" or "kuih-muih" for breakfast, and rice or noodles with two other dishes for lunch or dinner.

The participants suggested a snack food product made more acceptable to Malaysians, it should have acceptable taste, crunchy texture, bright packaging, and be easy to carry around.

3.1.3 Results of the Focus Group Discussion on the Proposed Product.

At first, it was quite difficult for the participants to give their opinion on the proposed product. As the idea was new to the participants and all the existing product samples used as example of a snack food in focus group session were different from the proposed product.

However, once the concept of the proposed product was described in detail by the researcher, the participants started to give their opinions on the proposed product. The discussion on the proposed product was based on ingredient combinations, product flavour and the types of drying processes and their preferences.

3.1.3.1. Proposed Product Combination.

Of the three mocked-up samples, the participants preferred the dried fruit and dried vegetable components to be separate. This was due to the shapes of the dried fruit which were slices and the shapes of the dried vegetables that were smaller in size. The fruit slices and vegetables would not mix very well if they were put in one package. The participants suggested the combination of tropical fruit such as mangoes, starfruit or pineapple, with the proposed product, as it was familiar to the target consumer.

3.1.3.2. The Flavour of Proposed Product.

The participants preferred natural flavours for dried mixed fruit samples, and spicy or salty for the dried vegetables. The participants thought the idea of fruit with a spicy flavour was not suitable for the proposed product. According to the participants' the fruit flavours and spicy flavours would did not mix very well and

it would give a strange taste. The participants suggested that natural flavours or sweet flavours were most suitable for the dried snack fruit product, and spicy or salty flavours were suitable for the dried vegetables snack food product.

3.1.3.3. Drying Process Preference for the Proposed Product.

The participants preferred the freeze-dried product samples to the air dried product samples as freeze dried product maintained the original shape, colour, and taste of the fruit. The participants found that freeze-dried products looked more attractive compared to the air dried product which looked too dried and the shape was a little shrunken. Also, the participants found that the texture of freeze dried product was more crunchy than the air dried product which had a hard chewy texture.

3.1.4. Conclusion from the Focus group.

The conclusions that were obtained from the existing product discussion were:

* The spicy or salty flavour was the most preferred flavour among the participants.
* The crunchiness was an important feature in snack product for Malaysians.
* The convenience and attractiveness of the packaging was an important factor for snack buying intention among the participants.

For the proposed product, the following conclusions were drawn:

* The participants preferred the combinations of fruit and vegetables separated rather than mixed together.
* The participants suggested the combination of proposed product have some tropical fruit familiar to the average Malaysian.

* The participants preferred the natural flavour for the dried fruit, and spicy or salty flavours for dried vegetables.
* The participants preferred freeze dried product compared to air dried product.

3.2. CONSUMER SURVEY.

A consumer survey was used to determine; how consumers use products similar to the proposed product, what products are presently on the market, and what consumers' attitudes would be to the new product.

The consumer survey was conduct with fifty-two Malaysian students at Massey University in order to determine their awareness, snacking pattern, preferred attributes and buying intention toward dried snack food. The consumer survey was carried out with two groups of Malaysian students; Malay and non-Malay students (Chinese) from various faculties.

3.2.1. Aim and Objectives.

The aim of this consumer study was to determine if there were the differences in attitudes, behaviour and preference characteristic of dried snack food product between the two ethnic groups of Malaysian students.

The objectives were:

* To obtain information regarding snacking pattern of the two ethnic groups.
* To identify snack buying behaviour within the two ethnic groups.
* To identify the attitudes toward the dried snack food product within the two ethnic groups.

* To indicate the preferred characteristics of new dried snack fruit product.

3.2.2 **Sample.**

Quota sampling was used in this consumer survey. The survey was conducted with fifty-two Malaysian students from various faculties at Massey University who has been study at Massey less than two years and aged between 18 and 30 years old. Twenty-six Malay students and twenty-six non-Malay students were choose (Table 3.1).

Table 3.3: The demographics' characteristics of the population sample in consumer survey.

	Number	Percentage
Ethnic: Malay	26	50%
Non-Malay (Chinese)	26	50%
Sex: Male	23	44%
Female	29	58%
Age (years): 18-20	7	13%
21-24	38	73%
25-30	6	11%

3.2.3. **Questionnaire.**

Based on the result of the focus group, a questionnaire for the survey method and the description of the proposed dried fruit snack was designed. The questionnaire for the consumer survey was composed of questions related to product awareness, snacking pattern, buying behaviour, brand and type usage, preferred attributes of new product, price and buying intention. Questionnaire testing was conducted before the survey with four Malaysian students. Modification of the questionnaire was made where necessary. The questionnaire used in the consumer survey is shown in Appendix 3.2.

3.2.4. **Survey Method.**

A self-administered survey was use in this survey. The questionnaires were handed out to the respondents. They were allowed to fill out the questionnaire, over approximately 2-3 days and then return it back.

3.3.5. **Data Processing.**

The data obtained from the consumer survey were processed by computer. The Minitab version 10.5 was use for the analysis. Data was analysed for its statistical significance of difference using ANOVA. The detailed results are tabulated in Appendix 3.3.

3.2.6. **Results of Consumer Survey.**

3.2.6.1. **Frequency of Snacking and Snack Type Preference in General.**

The percentage of frequency of snacking among the Malaysian students were showed in Table 3.4.

Table 3.4: Frequency of snacking and snack type preference.

	Total (52)	Malay (26)	Non-Malay (26)
Daily	4(8%)	3(11%)	1(4%)
Every two or three days	15(29%)	6(23%)	9(35%)
Weekly	6(11%)	3(11%)	3(11%)
Every now and then	**22(42%)**	**11(42%)**	**11(42%)**
Never	5(10%)	2(8%)	3(11%)

Note: percentage is given out of the total number of respondents, i.e. 26 Malay, 26 non-Malay and 52 total.

42% of the total students liked to eat the snack food "every now and then". The percentage of snacking for "every two or three days" was found higher for non-Malay students with 35% compared to 23% for Malay students. Overall, there was no significant difference ($p>0.05$) on frequency of snacking between the two ethnic groups of Malaysian students.

The percentage of snack type preference in general among the Malaysian students was showed in Table 3.5.

Table 3.5: Snack type preference

	Total	Malay	Non-Malay
Potato chips	**41(79%)**	**22(85%)**	**19(73%)**
Pickled snacks	6(11%)	1(4%)	5(19%)
Snack based on popcorn	6(11%)	4(15%)	2(8%)
Puffed snacks	6(11%)	2(8%)	4(15%)
Baked snacks	10(19%)	3(11%)	7(27%)
Nut based snacks	11(21%)	5(19%)	6(23%)
Malaysian product	2(4%)	1(4%)	1(4%)
Chocolate	2(4%)	0(0%)	2(8%)
Snack based on fruit	1(2%)	0(0%)	1(4%)
Not specified	4(8%)	1(4%)	3(11%)

Note: percentage is given out of the total number of respondents, i.e. 26 Malay, 26 non-Malay and 52 total.

Potato chips were the most preferred snack food product among the Malaysian students (79%) in which both ethnic groups, preferred potato chips more than other type of snack food This was, followed by nut based snack (21%) and baked

snack (19%). There was no significant difference ($p>0.05$) on snack type preference between the two groups of Malaysian students.

3.2.6.2. **Snacking Behaviour of Dried Snack Fruit.**

About 79% of Malaysian students had eaten dried snack fruit and 19% of Malaysian students had never eaten the product. The percentage awareness of the dried fruit product among Malaysian students are show in Figure 3.2.

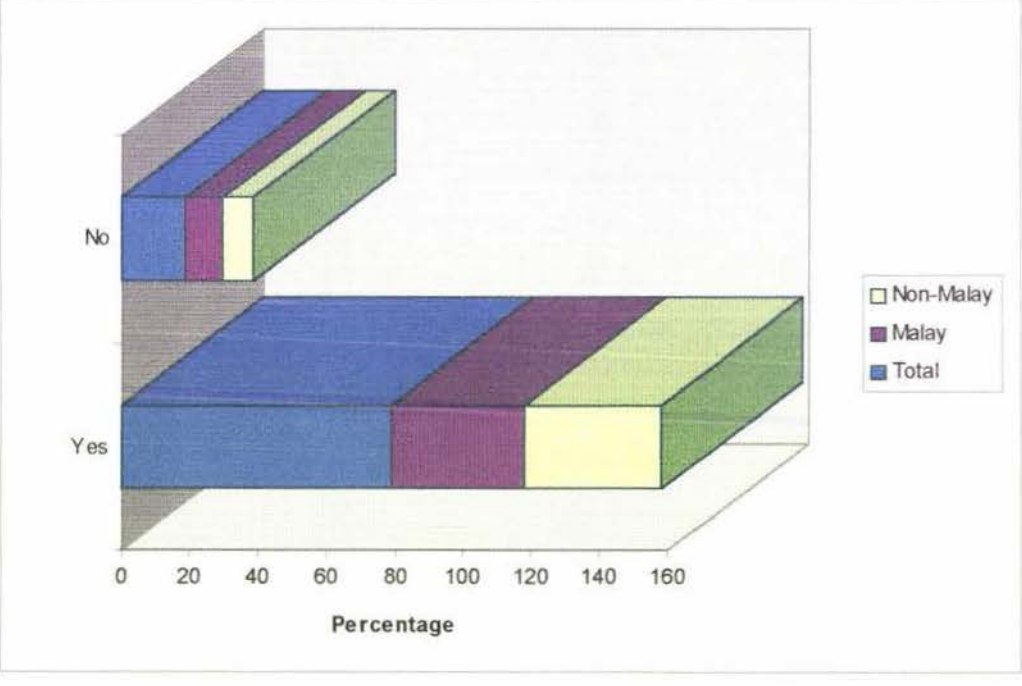


Figure 3.2: The awareness of dried snack fruit among the Malaysian students.

The result of frequency of snacking pattern among the Malaysian students was showed in Table 3.6.

Table 3.6: The frequency of snacking.

	Total (52)	Malay (26)	Non-Malay (26)
Daily	3(6%)	3(11%)	0(0%)
Every two or three days	4(8%)	3(11%)	1(4%)
Weekly	3(6%)	1(4%)	2(8%)
Every now and then	**23(44%)**	**8(31%)**	**15(58%)**
Sometimes	2(4%)	1(4%)	1(4%)
Once a month	1(2%)	1(4%)	0(0%)
Seldom	3(6%)	2(8%)	1(4%)
Fasting time	1(2%)	1(4%)	0(0%)
Occasionally	3(6%)	3(11%)	0(0%)
Once	1(2%)	0(0%)	1(4%)

Note: Percentage is given out of the total number of respondents, i.e. 26 Malay, 26 non-Malay and 52 total.

From this study it was found that 44% of Malaysian students like to eat dried snacks fruit "every now and then" (29% of were non-Malay students and 15% were Malay students). 6% of Malay students would eat dried fruit snack "daily" compared to 0% of non-Malay students. However, no significant difference

($p>0.05$) was found on frequency of snacking between the two ethnic groups of Malaysian students.

The percentage of dried fruit snack preference among the Malaysian students was showed in Table 3.7.

Table 3.7: Snack type preference.

	Total	Malay	Non-Malay
Dried prune	10(19%)	6(23%)	4(15%)
Dried apricot	11(21%)	3(11%)	**8(31%)**
Dried fig	1(2%)	0(0%)	1(4%)
Dried banana chips	13(25%)	6(23%)	7(27%)
Dried dates	6(11%)	4(15%)	2(8%)
Muscatels	1(2%)	0(0%)	1(4%)
Raisin	**19(36%)**	**11(42%)**	**8(31%)**
Sultanas	15(29%)	8(31%)	7(27%)
Dried plum	1(2%)	1(4%)	0(0%)
Not specify	2(4%)	0(0%)	2(8%)

Note: Percentage is given out of the total number of respondents, i.e. 26 Malay, 26 non-Malay and 52 total.

The most preferred dried fruit snack among the Malaysian students was raisin (36%).For Malay students, the three most preferred dried fruit snack in descending order were as followed: raisin (42%) , sultanas (31%), and banana chips and dried prune (23%). For non-Malay students the most preferable dried fruit snack were raisin (31%) and dried apricot (31%), followed by sultanas

(27%)and banana chips (27%). However, no significant difference was found ($p>0.05$) on dried fruit snack preference between the two ethnic groups.

3.2.6.3. **Criteria for Dried Snack Fruit Buying Choice.**

The results of dried snack fruit buying criteria was showed in Table 3.8.

Table 3.8: Criteria for dried snack fruit buying choice.

	Total	Malay	Non-Malay
Nutritious	10(19%)	4(15%)	6(23%)
Convenience	12(23%)	6(23%)	6(32%)
Like the taste	**20(39%)**	**11(42%)**	**9(35%)**
Fun	1(2%)	1(4%)	0(0%)
No particular reason	1(2%)	0(0%)	1(4%)
Just like something to munch	2(4%)	1(4%)	1(4%)
Just like to try it	1(2%)	0(0%)	1(4%)
Depend on mood	1(2%)	0(0%)	1(4%)
Don't like it	1(2%)	0(0%)	1(4%)

Note: Percentage is given out of the total number of respondents, i.e. 26 Malay, 26 non-Malay and 52 total.

The study of buying choice craters for dried fruit snacks showed that 39% of the respondents ranked taste as the most important criteria. Followed by convenience (23%) and nutrition (19%). This pattern was found for both ethnic groups. There

was no significant difference ($p>0.05$) was found on criteria of dried snacks fruit buying choices between the two ethnic groups.

3.2.6.4 Comparison Between the Proposed Dried Snack Fruit Product with the Existing Product.

The results of comparison between the proposed product and the existing product were in Table 3.9.

Table 3.9: Comparison between the proposed dried snack fruit product with the existing product.

	Total (52)	Malay (26)	Non-Malay (26)
Unique	7(13%)	4(15%)	3(11%)
Very different	8(15%)	3(11%)	5(19%)
Quite different	**18(35%)**	**8(31%)**	**10(38%)**
Similarly	7(14%)	5(19%)	2(8%)

Note: Percentage is given out of the total number of respondents, i.e. 26 Malay, 26 non-Malay and 52 total.

35% of Malaysian students (16% of Malay students and 19% of non-Malay students) found that the proposed product was "quite different" from the existing dried fruit snack product. About 13% of the respondents found the proposed product was unique and 14% of the respondents found the proposed product similar to existing product. Between the two ethnic groups, there was no significant difference ($p>0.05$) was found on the comparison between the proposed product and the existing product.

3.2.6.5. Preference Characteristics of the Dried Fruit Snack Product Proposal

From the proposed product description:

The product is new nutritious snack food, Nutri Bite, consist of mixture of dried fruit such as kiwifruit, peach, feijios, and apple with spices flavour. The product can be used as a snacker for leisure, party, and between meal. It will be packed in laminated aluminium packaging that is easy to carry everywhere.

The results of preference characteristics of the proposed dried fruit snack product were obtained (Table 3.10).

Table 3.10: Preference characteristics of product proposal.

	Total (52)	Malay (26)	Non-Malay (26)
Opinion on combination of product proposal.			
Very likely	4(8%)	2(8%)	2(8%)
Quite likely	**16(31%)**	**10(38%)**	6(23%)
Neither likely or unlikely	13(25%)	5(19%)	**8(31%)**
Quite unlikely	5(10%)	3(11%)	2(8%)
Very unlikely	14(27%)	6(23%)	**8(31%)**
Opinion on proposed product flavour.			
Natural	**21(40%)**	**12(46%)**	**9(35%)**
Spices	7(13%)	2(8%)	5(19%)
Sweetness	13(25%)	8(31%)	5(19%)
Cheese	1(2%)	1(4%)	(0%)
Natural flavour with nut	1(2%)	0(0%)	1(4%)

Note: Percentage is given out of the total number of respondents, i.e. 26 Malay, 26 non-Malay and 52 total.

From this study, a majority of Malay students (46%) liked the fruit combination of the product proposal as compared to 31% of non-Malay students. On the other hand, about 39% of non-Malay students disliked the fruit combination of the product proposal compared to 37% of Malay students. However, no significant difference ($p>0.05$) was found between the two ethnic groups of Malaysian students on their opinion toward the proposed product ingredient combination.

Table 3.4. was also shows the preferences of the proposed flavour opinions. 40% of the respondents preferred the natural flavour for the proposed product. Followed by sweetness (25%) and spicy (13%). From the statistical analysis, there was no significant difference ($p>0.05$) was found in the opinion of the proposed product flavour between the two ethnic groups.

3.2.6.6. **Expected Price of the Proposed Product.**

The most preferred price the Malaysian students would pay for the proposed product at weight of 100gm was $1.20 (23%: 13% were Malay students and 10% were non-Malay students). 13% of the respondents would prepared to pay $2.00 and $1.50 for the proposed product and none of the respondent would prepared to pay $3.00 for the proposed product at the 100gm. There was no significant difference ($p>0.05$) found on the expected price of the proposed product between the two ethnic groups of Malaysian students.

Table 3.11: Expected price of the proposed product.

	Total (52)	Malay (26)	Non-Malay (26)
Expected price.			
$3.00	0(0%)	0(0%)	0(0%)
$2.50	3(6%)	1(4%)	2(8%)
$2.00	7(13%)	4(15%)	3(11%)
$1.80	8(15%)	3(11%)	5(19%)
$1.50	7(13%)	3(11%)	4(15%)
$1.20	**12(23%)**	**7(27%)**	**5(19%)**
$1.00-0.50	3(6%)	1(4%)	2(8%)
Depends on product	1(2%)	1(4%)	0(0%)

Note: Percentage is given out of the total number of respondents, i.e. 26 Malay, 26 non-Malay and 52 total.

3.2.6.7. **Buying Intention of the Proposed Product.**

Most of the Malaysian students (52%) would buy the proposed product if it were available in the supermarket compared to 4% of them who would not buy the proposed product (Table 3.12). Of the two groups of Malaysian students, Malay students (65%) had the higher percentage of buying intention compared to non-Malay students (39%). However, the decision of "might buy or might not buy" was higher for non-Malay students (15%) compared to Malay students (4%). The statistical analysis showed that there was no significant difference ($p>0.05$) on buying intention of the proposed product between the two ethnic groups of Malaysian students.

Table 3.12: Buying intention.

	Total (52)	Malay (26)	Non-Malay (26)
Definitely buy	2(4%)	1(4%)	1(4%)
Probably buy	**25(48%)**	**16(61%)**	**9(35%)**
Might buy or might not buy	5(10%)	1(4%)	4(15%)
Probably not buy	2(4%)	0(0%)	2(8%)
Definitely not buy	0(0%)	0(0%)	0(0%)

Note: Percentage is given out of the total number of respondent, i.e. 26 Malay, 26 non-Malay and 52 total.

3.2.6.8 **Expected Frequency of Buying the Proposed Product.**

The expected frequency of the buying the proposed product compared to the regular snack food product was show in Table 3.13.

Table 3.13: Expected frequency of buying the proposed product.

	Total (52)	Malay (26)	Non-Malay (26)
Daily	2(4%)	2(8%)	0(0%)
Every two or three days	5(10%)	3(11%)	2(8%)
Weekly	**14(27%)**	**8(31%)**	**6(23%)**
Once	11(21%)	5(19%)	6(23%)
Never	2(4%)	0(0%)	2(8%)

Note: Percentage is given out of the total number of respondent, i.e. 26 Malay, 26 non-Malay and 52 total.

About 27% of Malaysian students would buy the proposed product weekly (15% were Malay students and 12% were non-Malay students). Of the two ethnic groups, Malay students would by the proposed product more regularly (8% of Malay students would buy the proposed product "daily", and 11% would buy "every two or three days) as compared to non-Malay students (none of them would buy the proposed product "daily" , and 8% would buy "every two or three days). However, no significant difference ($p>0.05$) was found on expected frequency of buying the proposed product between the two ethnic groups.

3.2.7. **Discussion of Consumer Survey.**

3.2.7.1. **Snacking Pattern and Snack Type Preference in General Between the Two Ethnic Groups.**

There was no significant difference ($p>0.05$) found on snacking pattern between the two groups of Malaysian students. For both groups, they liked to eat snack food for "sometimes" because snacking was not their regular eating habit. This confirms in this study which only 4% of the respondents eat snack food daily. This is probably to the Malaysian culture of eating heavier meals such as rice with two other dishes for lunch and dinner.

However, it was found that 94% of Malaysian students eat snack food (48% were Malay students and 46% were non-Malay students), and potato chips seemed to be the snack food product most Malaysian students ate (79%). Followed by nut based snack food (21%) and baked snacked (19%). Pickled snacks, snack based on popcorn and puffed snacks were not popular among Malaysian students. This was probably due to the taste of the three snack food products that were available here did not really fit to the Malaysian taste compared to Malaysian product. If

the study was conducted in Malaysia the result of study may slightly different. However, from this study, there was no significant difference ($p>0.05$), between the two groups of Malaysian students on snack type preference.

3.2.7.2. **Snack Buying Behaviour for Dried Snack Fruit Between the Two Ethnic Groups.**

For dried fruit snack product, 79% of Malaysian students at Massey university had eaten dried fruit snack and 19% of Malaysian students had never eaten the product (11% were Malay students and 8% were non-Malay students).

Raisins seemed to be the dried snack food product most Malaysian students eat. Followed by sultanas and dried banana chips . It was surprising to learn that dried apricot which was not popular dried fruit snack in Malaysia was among the five dried snack fruit products most Malaysian students ate. This may be due to the familiarity of apricot fruit by the Malaysian students in New Zealand as the apricot fruit is available in all supermarkets here with cheaper prices as compared to Malaysia where the apricot fruit is very expensive

44% Malaysian students eat dried snack fruit product "every now and then" (15% were Malay students and 29% were non-Malay students). Even though the percentage of awareness of the dried snack fruit for non-Malay students were higher than Malay students, Malay students eat dried fruit snack products more frequently compared to non-Malay students. This was confirmed by the percentage of "daily" and "every two or three days" snacking pattern (see Table 3.11). However, no significant difference, ($p>0.05$) was found between the two groups of Malaysian students on snacking pattern of the dried snack fruit product.

3.2.7.3. Criteria for Dried Snack Fruit Products Buying Choice.

The study on the main criteria of buying choice for dried snack fruit products shows that there was no significant difference ($p>0.05$) between the two ethnic groups of Malaysian students. The three most important criteria for a dried fruit snack product in descending order were as followed: taste, convenience and nutrition. According to this study, the ethnic factor had no influence in this ranking of the main criteria's because both ethnic groups gave the highest percentage for taste as their important criteria of buying choice.

This showed that in developing any snack food products which would be acceptable for the Malaysians , the developer would have to indicate an acceptable flavour for the product, therefore the product can be marketed in Malaysia. In addition, the snack food product must be pack in the type of packaging which is easy to be carried and stored.

3.2.7.4. The Comparison of the Proposed Dried Fruit Snack with the Existing Product.

The results of consumer survey on comparison of the product proposal with an existing product revealed that 35% of respondents found the proposed product quite different from the existing product and, 14% found it similar to the existing product.This result was obtained because the proposed dried fruit snack product was based on New Zealand fruits which were familiar by most of the Malaysian students here since all of the respondents in this survey are studying in New Zealand. The data will be slightly different if the survey was done in Malaysia.

3.2.7.5. **Characteristics of Product Proposal.**

For the preference characteristics of the proposed product (refer to the proposed product description in section 3.2.6.5). The study shows that between the two ethnic groups, non-Malay students gave the highest percentage (31%) of unlocking the combination of the proposed product compared to Malay students (23%).On the other hand, 46% Malay students liked the combination of the proposed product compared to 31% of the non-Malay students. No attempt was made to indicate the reason why these result was obtained because the design of the questionnaire did not explain why this result was obtained.

Nevertheless, no significant difference ($p>0.05$) was found between the two groups of Malaysian students on their opinion toward combination of the proposed product.

For the proposed product flavour, the study showed that the natural flavour of the product was the most preferred flavour among the respondents. Followed by sweetness . The idea of using the spicy flavour for the proposed product was less acceptable by the respondents as the spicy flavour was ranked third.

There was slight difference of product flavour preference between the two ethnic groups of Malaysian students. For Malay students, the most preferred product flavour in descending order were as follows: natural, sweetness, and spicy. Likewise, for non-Malay students, the most preferred product flavour in descending order were as follows: natural, spicy, and sweetness. The slightly differences of product flavour preference among the Malaysian students may due to the variation on the opinion of the proposed product flavour. Overall, there was no significant difference ($p>0.05$) found between the two groups of Malaysian students in their opinion toward proposed product flavour.

3.2.7.6. **Expected Price and Buying Intention of Product Proposal.**

The most preferred price the respondents would prepared to pay for the proposed product was at the price of $1.20 (23%) for the size of 100gm. Followed by $1.80 (15%) and $1.50 (13%). This implied the price of the regular snack food products sold in Malaysia which most of the snack food products in Malaysia were sold with the price of $0.70 to $1.50.

From this study, none of the respondents would be prepared to pay for the proposed product at the price of $3.00. This showed that if the proposed product could be develop and sold at a price higher than $2.50, there will be lower market potential for the proposed product since the competitor products has much lower price.

For buying intention, 52% of the respondent indicated that they would buy the product if it were available in the supermarket and 4% of the respondents would not buy the proposed product. This showed that the proposed product has moderate market potential if it were developed for the Malaysian market.

However, from the study it shows that 65% of Malay students would buy the product compared to only 39% of non-Malay students and, about 0% of Malay students would not buy the proposed product compared to 8% of non-Malay students. It was difficult to figure out the differences in percentage of buying intention decision between the two ethnic groups since the design of the questionnaire did not indicate the reason.

According to the expected frequency of buying intention percentage, 27% of Malaysian students would buy the product weekly and 21% the respondents would only buy the product once compared to their regular dried snack fruit products. This might be due to the unfamiliarity of the proposed product to the

respondents and also due to the Malaysian students snacking habit which they only eat dried snack food for sometimes.

Of the two ethnic groups, no significant difference ($p>0.05$) was found on expected frequency of buying intention on the proposed product and also on buying intention of the proposed product.

3.2.3. **Conclusion.**

From the consumer survey, it can be summarised that there no significant differences on awareness, snacking pattern, attitudes, behaviour and preference characteristic buying intention toward snack food, dried snack food and proposed product between the two ethnic groups of Malaysian students. Thus, Malaysian students can be treated as homogenous group for any further study in this project.

From this study , the natural flavour was most preferred among the Malaysian students for the proposed product compared to spicy' flavour which had been suggested for the proposed product. From the preference criteria's' for the dried fruit snack buying choice, the taste of the proposed product was the most important attribute for the Malaysian students. From the expected price, the price over $3.00/100gm was found not acceptable by the respondents.

From this survey, the market potential of the new product can be predicted through the percentages of proposed product acceptability, expected price, expected frequency buying intention and buying intention.

CHAPTER 4.

IDEA GENERATION.

Once the project has been defined, the next step of product development is idea generation. The search for new-product ideas should be systematic rather than random especially since this process is such a crucial step in the product development process (Kotler and Amstrong, 1991). Although many ideas are obtained through the idea generation process, most will not be appropriate ones for the project.

In the present study, the idea generation stage was conducted using Malaysian students so that new product ideas of a food product based on dried fruit and vegetables could be generated and explored. For this purpose the nominal group technique (NGT) was used as it is well structured, quick and easy for the respondents (Wan, 1987). NGT consists five steps; firstly, silent generation, secondly, round robin presentation, thirdly, clarification, fourthly, ranking, and finally, discussion.

4.1. EXPERIMENTAL METHOD.

At the session six Malaysian students between the ages of 20 to 25 years were chosen. The participants who participated in the focus group discussion for the preliminary study were chosen again for this session. The group consisted of five Malay students (two male students and three female students) and, one Chinese female student. A brief introduction to the nominal group technique was given to them and the rules were explained . At the same time a brief explanation of the purpose of idea generation was given, and the project's objectives were also presented.

In silent generation, the participants were given 15-20 minutes to write down their ideas. In round robin presentation, the participants were individually asked to state one of the ideas they had arrived and recorded on the board, and they were also asked to give a brief explanation. The process was repeated until all ideas by the participants were stated.

When all the ideas had been collected, the session was then proceed to the fourth step of NGT. In clarification stage, each idea was discussed in turn by the group, so as to clarify and expand them and, the participants were encouraged to generate more ideas.

Then, the session proceeded to the ranking process. The participants were ask to list down eight of their most preferred ideas and rank them from 1 to 8, (1 being "the least preferred" while 8 was "the most preferred"). The ranking score from the participants were added together and the top eight were selected. The session was ended by the group discussion based on the results obtained from the NGT session.

4.2. IDEAS PRODUCED BY THE NOMINAL GROUP TECHNIQUE.

Forty-one new-product ideas were generated from a two hour nominal group technique (NGT) session (Table 4.1). From 41 product ideas, 26 preferred ideas were selected by the participants from the preliminary ranking process (Table 4.2).

Table 4.1: The list of ideas produced by the Nominal Group Technique.

* Dried Feijoas, Kiwanos, Kiwifruit and Boysenberry (individually) with natural flavour.
* Mixture Feijoas, Kiwanos, Kiwifruit with natural flavour.
* Munchous Apple and feijoas sweetly and salted.
* Mixed vegetable with natural flavour.
* Nashi and Apple (individually) crunchy.
* Potato, Kumara and Sweet corn chips.
* Nanchos-fruit and vegetable with dip.
* Mixture fruit and vegetable with natural flavour.
* Kiwifruit pulp(slices), peas and nut-salted with muruku.
* Corn and cabbage chips.
* Apple ball.
* Fruit chips.
* Vegetable chips with cheese or BBQ flavour.
*Sweet corn and Potato chips with chilli flavour
* Pizza cracker chips cover with fruit and vegetable.
* Tomato chips.
* Fruit skins. e.g. Apple.
* Carrot ball with spices flavour.
* Crunchy Carrot ball.
* Carrot, Apple, Feijoas (individually) stick.
* Fruit fingers.
* Mixed fruit with natural flavour.
* Pie filling-mixture fruit and vegetable.
* Mixed fruit for cocktail.
* Instant noodle with Cabbage, Carrot and Peas.
* Mixed fruit and vegetable with pasta.
* Dried mushroom.
* Dried fruit coated with chocolate.
* Fruit icing.
* Fruit coated with honey.
* Nashi and Apple (cube) coated with sugar.
* Coconut candy with Apple.
* Apple and Feijoas with filling.
* Strawberry chips with sugar coated.
* Sandwich biscuit with fruit.
* Fruit biscuit.
* Wafer dried fruit.
* Cone fruit.
* Apple, Nashi and Bean muesli bar.
* Apple, Nashi and Bean fruitflakes.
* Fruit weet bix.

Table 4.2: The preliminary product ideas evaluation results.

* Dried Feijios, Kiwanos, Kiwifruit and Boysenberry (individually) with natural flavour.
* Kiwifruit pulp(slices), peas and nut-salted with muruku.
* Corn and cabbage chips.
* Apple ball.
* Fruit chips.
* Vegetable chips with cheese or BBQ flavour.
* Sweet corn and Potato chips with chilli flavour.
* Fruit skins. e.g. Apple.
* Carrot, Apple, Feijios (individually) stick.
* Fruit fingers.
* Mixed fruit for cocktail.
* Instant noodle with Cabbage, Carrot and Peas.
* Mixed fruit and vegetable with pasta.
* Dried mushroom.
* Dried fruit coated with chocolate.
* Fruit coated with honey.
* Nashi and Apple (cube) coated with sugar.
* Coconut candy with Apple.
* Strawberry chips with sugar coated.
* Sandwich biscuit with fruit.
* Fruit biscuit.
* Wafer dried fruit.
* Cone fruit.
* Apple, Nashi and Bean fruitflakes.
* Fruit weet bix.

4.3. DISCUSSION OF IDEA GENERATION BY THE NOMINAL GROUP TECHNIQUE.

For most of the participants it was their first NGT session. However, they preferred it to an open discussion. This was due to the nature of NGT as the tight structure of the technique had minimised the disruption and arguments between the participants. Furthermore, NGT gave an equal opportunity to all the participants.

session then proceeded to on the round robin presentation where each participant was given an equal opportunity to state their own ideas, and this was found to reduce competition between the participants. Moreover, it reduced the influence of a dominant participant.

The session proceeded to the clarification process where the group concluded that some ideas could be eliminated or combined because of their similarity. In the ranking process, twenty-six ideas were listed. It was found that most of the participants preferred to choose their owns ideas instead of other participants' ideas. Because of this, the researcher terminated this ranking step without asking the participants to indicate the eight most preferable ideas they could obtained as in group and eliminate the results of preliminary product ideas evaluation form further consideration in this study.

4.4. **CONCLUSION.**

From this NGT session, forty-one new product ideas were generated and preliminary product idea evaluation was carried out. However, the results from this process could not be used for further consideration because during the evaluation process most of the participants preferred to choose their own ideas. Due to that, all the forty-one ideas that were suggested from this session will undergo a formal screening procedure for further evaluation.

CHAPTER 5.

SCREENING IDEA.

Once a list of new product ideas had been obtained, the forty-one ideas needed to be evaluated to indicate which idea had the greatest potential for further development. In the product development process the purpose of the idea generation stage is to create a large number of ideas without any evaluation and the screening phase is used to identify the good ideas and drop poor ones as soon as possible because the product development costs rise greatly in later stages (Kotler and Amstrong, 1991).

For the purpose of this project, the screening technique was conducted in three different steps: sequential screening, checklist screening, and probability screening. These steps were chosen because they can be done easily, quickly and systematically (Wan, 1987).

5.1. EXPERIMENTAL METHOD.

5.1.1. Sequential Screening.

The sequential screening technique consisted of pass fail systems and the product ideas were evaluated on the basis of specific project requirements (Section 1.5). The purpose of this early stage of screening was to rapidly eliminate product ideas that did not comply with the project strategy and consumer acceptance. There were forty-one product ideas produced from the idea generation phase. Each ideas was evaluated against the limiting constraints using the pass-fail system. The failed product ideas were rapidly screened out. At this stage, screening was only done by the researcher. Three screening criteria were used in this screening stage:

production compatibility, market acceptance and preferred flavour (Appendix 5.1).

Production compatibility- For this project, only the dehydrating equipment available in the Pilot Plant Labotrary, Department of Food Technology, Massey University was used to produce the new dehydrated food product. It was necessary to indicate production compatibility of the each product idea using the existing dehydrating equipment available in Pilot Plant Labotrary.

Market acceptance- As the aim of this project was to develop a dried snack food product that was acceptable by Malaysian. It was important to determine the market acceptance for each product idea because the product idea of developing a dehydrated snack fruit product was new in the Malaysian market.

Preferred flavour- From the consumer study (Chapter 3) that was carried out using the Malaysian students, it was found that the consumers considered taste/flavour as important characteristics in a snack food product. Due to this, preferred flavour criteria was chosen as one of the constraints for screening.

The twenty-one product ideas that passed the initial stages of screening proceeded to the checklist screening step.

5.1.2. **Checklist Screening.**

The second stage of screening was the checklist screening. At this stage twenty-one product ideas were rate on three criteria (market acceptability, production compatibility, and preferred flavour) where each criterion had been ranked and weighted in order of importance.

At this stage, screening was done by the researcher and thirty Malaysian students. They were asked to indicate their eight most preferred product ideas from the product ideas' list) for market acceptability score (Appendix 5.2).

For production compatibility and preferred flavour scores, the evaluation was done by the researcher only. Each product idea was scored from one to ten based on each criteria and then individual product idea score was multiplied by a factor weighting. For example:

	Production compatibility (6)	Preferable flavour (4)	Total score
Fruit fingers	7	7	70
(Product idea score multiply by a factor weighting).	(6x7)	(4x7)	(42+28)

For market acceptability, thirty Malaysian students were shown a list of 41 product ideas. They were then asked to select their eight most preferred product ideas and rank them from 1 to 8 (1 as the least preferred idea and 8 as the most preferred idea). The total score for a given idea was calculated by the sum of the scores given by all the panelists for that particular idea, divided by ten. Then each individual product idea was multiplied by their respective market weighing.

From the checklist screening, a range of total scores from 39-185 was obtained. It was decided that a cut-off score of 95, 50% of the total score, be used. Any product ideas that scored less than 95 were eliminated

5.1.3. **Probability Screening.**

Probability screening was used as the last stage of screening. The purpose of this screening step was to indicate production capability and consumer preference of the highest potential product ideas in more depth evaluation. The probability screening was done by the researcher only. At this stage, three basic groups of screening criteria namely, market acceptability, production compatibility, and preferred flavour were used and these were divided into eight sub-criteria:

In probability screening, each sub-criterion was rated out of 120 points. Each sub-criterion had weighing ranging from ten to twenty based on their relative importance. The descending order of sub-criteria according to their relative importance is shown in Table 5.1.

Table 5.1: The sub-criterion's with their respective weighing.

Sub-criteria	Weighing
Consumer acceptance.	20
Equipment and facility for research and development	18
Development and production difficulty.	16
Development cost and time	15
Cost of raw material	15
Product image	14
Newness	12
Size and market potential	10

Consumer acceptance- As the aim of this project was to develop a snack food product that was acceptable to the Malaysian market, it was important to put consumer acceptability as the major sub-criterion. Consumer acceptance was rated on a 20 point scale depending on its relative importance.

Equipment and facility for research and development- As dehydrating equipment available in Pilot Plant Labotrary, Department of Food Technology, Massey University was solely used to produce the new dried product, this sub-criterion became second most important on the list. This part was evaluated using an 18 point scale by the researcher.

Development and production difficulty- As this was only a one year project and due to the limitation of production compatibility, it was necessary to indicate the difficulty of development and production of each product idea. This sub-criterion along with the following were evaluated using similar scales as the two shown above.

Development cost and time, and cost of raw materials- Due to the variety of snack foods available on the Malaysian market at very competitive prices, and the time restriction of this project, the final product had specific requirements and they were: i) being competitive in price

ii) produced within the allocated time.

Product image- This sub-criterion referred to the importance of taste and convincing attributes of the new product (see Chapter 3).

Newness- As there was a variety of snack foods on Malaysia market, it was important for the new product to have a unique selling point in order to be competitive.

Size and market potential- Since there was a wide variety of snack foods available on Malaysia market, it was appropriate to evaluate the market potential for the new product.

A total score of all the 8 sub-criterion was then calculated from the sum of the individual scores. Total scores ranging from 98-109 out of a maximum of 120 were obtained. A cut-off of 105 was selected for the probability screening, because 105 was found to be the median score between 98-109 and any product idea score above 105 was evaluated as the most potential product idea. The probability screening table is shown in Appendix 5.4.

5.2. RESULTS OF SCREENING PRODUCT IDEAS FOR A DRIED FRUIT OR VEGETABLE SNACK FOOD.

There were three different stages of screening selected to identify the best product ideas for further development in this project: sequential screening, checklist screening and probability screening. Through this screening system the number of product ideas was reduced from forty-one to three (Figure 5.1).

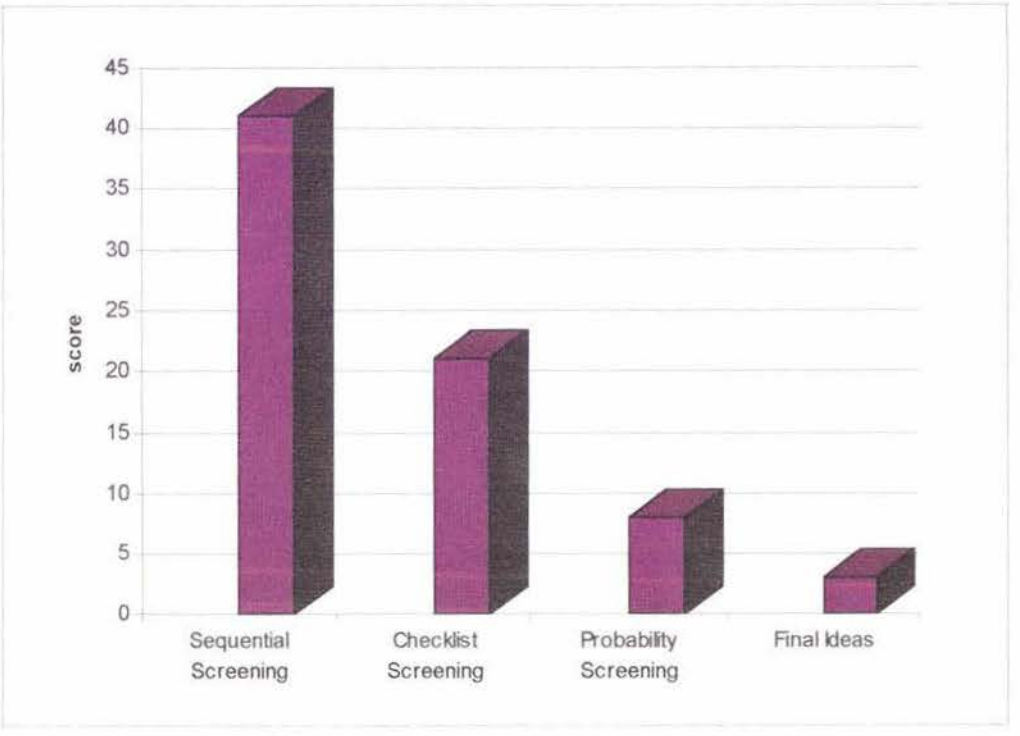


Figure 5.1: The histogram of reduction the number of product ideas through screening process.

In the sequential screening, 41 product ideas were reduced to 21 product ideas. The product ideas that passed the initial stage of screening proceeded to the next phase, checklist screening. The 21 products remaining after the sequential screening are listed in Table 5.2.

Table 5.2: The list of product ideas that remained after Sequential Screening.

* Dried Feijoas, Kiwanos, Kiwifruit and Boysenberry (individually) with natural flavour.

* Mixture Feijoas, Kiwanos, Kiwifruit with natural flavour.

* Mixed vegetable with natural flavour.

* Nashi and Apple (individually) crunchy.

* Mixture fruit and vegetable with natural flavour.

* Apple ball.

* Fruit chips.

* Vegetable chips with cheese or BBQ flavour.

* Fruit skins. e.g. Apple.

* Carrot ball with spicy flavour.

* Carrot, Apple, Feijoas (individually) stick.

* Fruit fingers.

* Mixed fruit with natural flavour.

* Pie filling-mixture fruit and vegetable.

* Mixed fruit for cocktail.

* Fruit icing.

* Nashi and Apple (cube) coated with sugar.

* Apple, Nashi and Bean muesli bar.

* Apple, Nashi and Bean fruitflakes.

In checklist screening, any product ideas that have less than 95 score point were drop from further screening process. From 21 product ideas, it was reduced to eight (Figure 5.2).

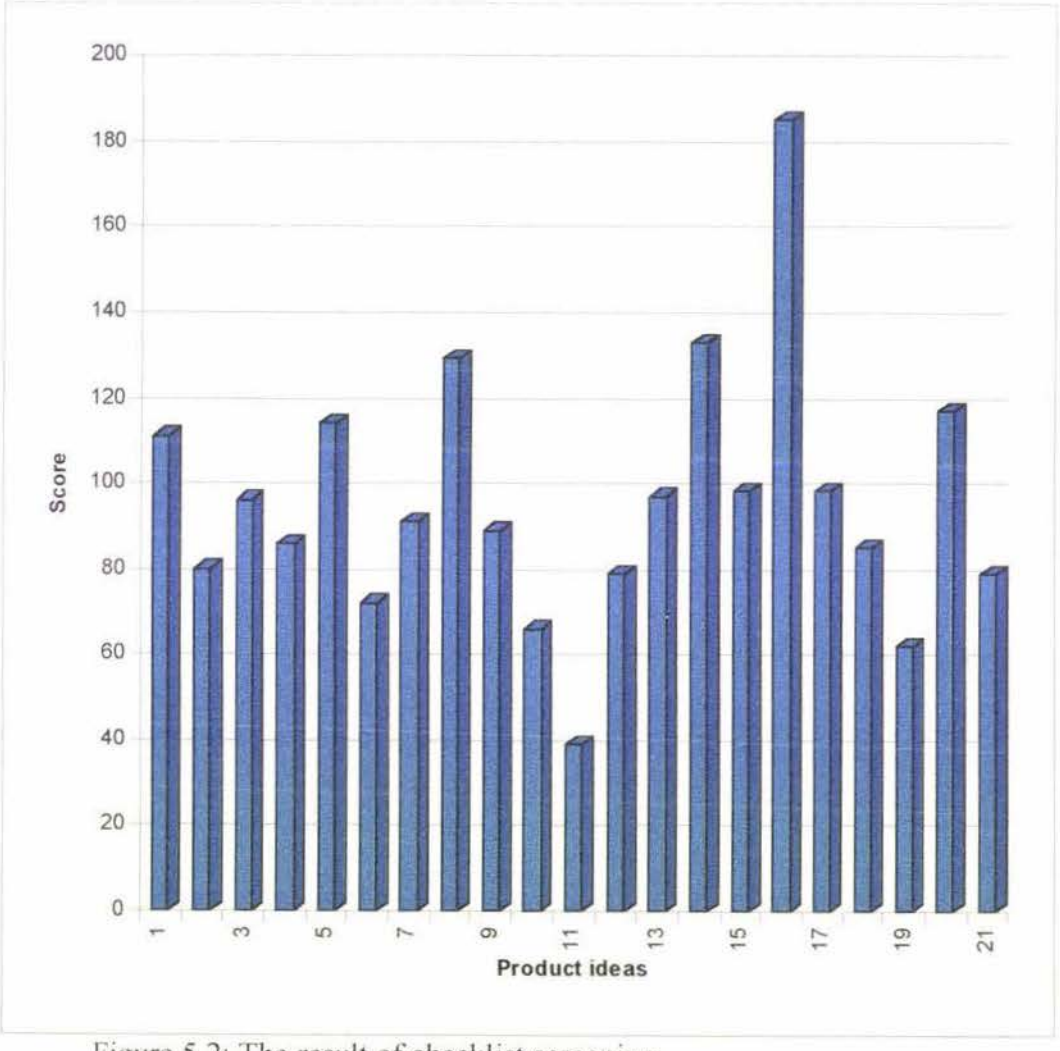


Figure 5.2: The result of checklist screening.

The 8 product remaining after the checklist screening are shown in Table 5.3.

Table 5.3: The list of the product ideas that remained after Checklist Screening.

* Dried Feijoas, Kiwanos, Kiwifruit and Boysenberry (individually) with natural flavour.
* Mixed vegetable with natural flavour.
* Mixture of fruit and vegetables with natural flavour.
* Vegetable chips with cheese or BBQ flavour.
* Fruit fingers.
* Mixed fruit with natural flavour.
* Pie filling-mixture of fruit and vegetables.
* Mixed fruit for cocktail.
* Fruit icing.
*Apple, Nashi and Bean fruitflakes.

From the probability screening, any product ideas that have more than 105 point from out of 120 point were chosen for further development in this project Thus, eight product ideas were reduce to three for further analysis (Figure 5.3).

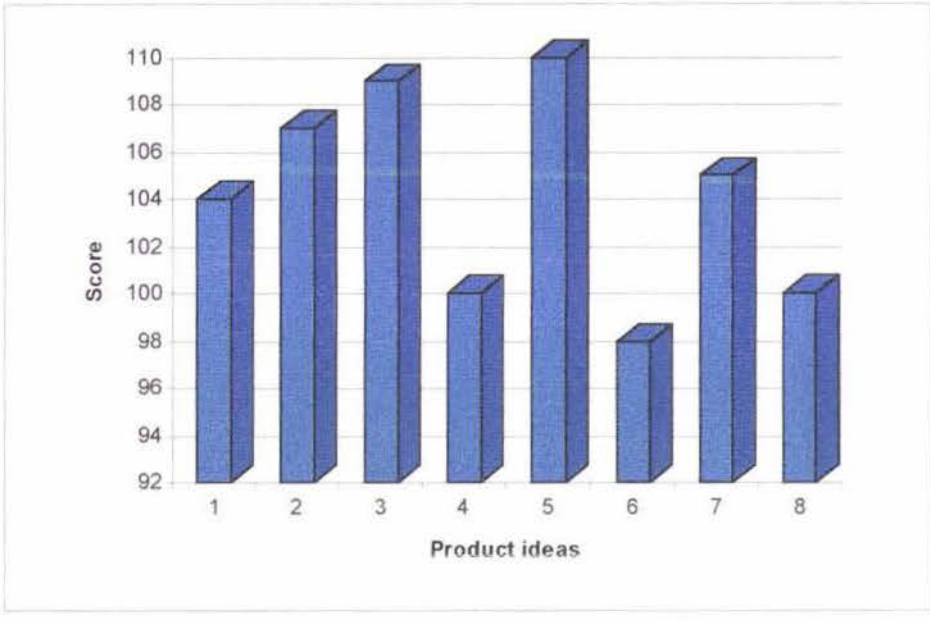


Figure 5.3: The results of probability screening.

The 3 product ideas that will proceed on to the product concept testing stage in this project are shown in Table 5.4.

Table 5.4:The list of product ideas that remained after Probability Screening.

* Mixed vegetable with natural flavour.
* Mixture fruit and vegetable with natural flavour.
* Mixed fruit with natural flavour.

5.3. DISCUSSION OF SCREENING PRODUCT IDEAS FOR A DRIED FRUIT OR VEGETABLE SNACK FRUIT.

The main purpose of the idea screening was to select the best ideas which to satisfied the goals most important to the project. In this project, the scoring model which consisted of sequential screening, checklist screening, and probability screening, was used because of its simplicity and the systematic process of short listing the good ideas.

In sequential screening, 21 out of 41 product ideas were passed and proceeded on to the checklist screening. The other 20 product ideas were failed because of production difficulties in the Pilot Plant Laboratory at Department of Food Technology, Massey University. During the In checklist screening, 21 product ideas were reduced to eight. The eight product ideas, were than reduced to three in the probability screening session. These three product ideas proceeded on to the product concept testing stage in this project.

During evaluation of the product ideas, three main criteria were used: production capability, market acceptance and preferred flavour. The preferred flavour had been chosen as one of the main criteria because taste was considered a main characteristic for Malaysian students when selecting snack food product.

To obtain market acceptability score of the product ideas during the checklist screening, thirty Malaysian students were asked to participate as there was no reference data for the researcher to refer to which indicated market potential of the dried fruits product. It was found that market acceptability scores had a significant effect on the total score of each product idea than product compatibility or preferred flavour criteria during checklist screening.

5.3. CONCLUSION OF PRODUCT IDEAS FOR A DRIED SNACK FRUIT OR VEGETABLE SNACK FOOD.

By using this screening system, three potential product ideas, dried mixed vegetables, dried mixed fruit and dried mixed fruit and vegetables were obtained. These three product ideas proceeded on to the concept product testing stage and were tested using target consumers to determine consumer acceptability.

By using these screening processes, it helped the researcher make decision by selecting and rating the screening criteria and this avoided the researcher from focusing on irrelevant factors. Throughout the screening process, three basic groups of screening criteria were used: production compatibility, market acceptance, and preferred flavour, these criteria were the major constraints in developing a dried snack fruit for the Malaysian market in this project.

In these screening processes, target consumers had been chosen for evaluation of the product ideas. The idea of using the consumer in this process was to testify consumer acceptance and market potential of the new product ideas. Overall, in order to meet the needs and expectations of the consumers and to satisfy the goals of this project, it was necessary to combine the consumer input and technical ability to produce potential product ideas.

CHAPTER 6.

PRODUCT CONCEPT TESTING.

In product concept testing, the three potential product ideas which had been identified during the screening, were presented to the target consumer. In this project, the product concept was tested in two forms: concept description and concept prototype using two techniques: focus group and survey method.

There were five objectives to be obtain from this product concept testing. These were:

* To provide direction for the development of a dried snack product for the Malaysian market.
* To identify any significant differences in the attributes and preferences of the proposed product using two different forms of concept testing.
* To identify any significant differences in the attributes and preferences of the proposed product by two different techniques.
* To identify the differences between the two techniques as regards to time requirements.
* To indicate relative cost for the two techniques.

To obtain the five objectives in this project, the product concept testing was carried out using the Malaysian students who study at Massey University.

6.1. SAMPLE IN PRODUCT CONCEPT TESTING.

The product concept testing was conducted using fifty-six Malaysian students from various faculties. Twenty-eight students were assigned to the focus group, and twenty-eight students to the survey method (Table 6.1). The Malaysian

students were not divided into their ethnic groups because the consumer survey (Chapter 3) showed there was no significant difference in attitudes and behaviour toward the dried snack fruit product between two ethnic groups, Malay and Chinese.

All panelists chosen for the product concept testing were Malaysian students who have been studying in New Zealand for less than two years and who regularly eat dried snack fruit.

Table 6.1: The demographics' characteristics of the population sample in product concept testing.

	Focus Group	Survey method
Ethnic: Malay	28(100%)	12(43%)
Non-Malay	0(0%)	16(57%)
Gender: Male	10(36%)	12(43%)
Female	18(64%)	16(57%)

6.2. QUESTIONNAIRE.

To fulfil the objectives of this study, a questionnaire was set up for both techniques for statistical analysis. The questionnaire was composed of questions related to product concept preference, product attributes, purchasing price and buying intention. Before the questionnaire was distributed among the panelists, a discussion was carried out between the researcher and the supervisor. Modification of the questionnaire was made where necessary. The questionnaire

used in the product concept testing are shown in Appendix 6.1 for the focus group and Appendix 6.2 for the survey method.

6.3. DATA PROCESSING.

The data obtained from the two techniques of the product concept testing were processed by computer. The Minitab programme version 10.5 was used for analysis. Data was analysed for its correlation (Pearson correlation), and statistical significance of difference by ANOVA . The detailed results are tabulated in Appendix 6.3.

6.4. PRODUCT CONCEPT DESCRIPTION.

From the idea screening stage, three potential product ideas were obtained. These were: dried mixed fruit, dried mixed vegetables and dried mixed fruit and vegetables. The types of fruit or vegetable to be use in the proposed product were not indicated in the list of product ideas. Six criteria were chosen as a guideline for the researcher when choosing the types of fruit and vegetables to be used to develop product concepts for testing.

The factors were:

* The fruits and vegetables were available throughout the year.
* The price/kg of each fruit and vegetable was inexpensive (between $0.50-$2.00/kg).
* Available at any supermarket in Palmerston North.
* The fruits and vegetables can be process using the existing equipment in the Pilot Plant Laboratory, Department of Food Technology, Massey University.
* The fruits and vegetables must be familiar to the target consumer

* The fruits and vegetables must have an attractive colour and shape.

By considering by these factors, three fruits and three different vegetables were chosen, namely, red apple, kiwifruit, strawberry, carrot, pumpkin and peanut.

In this project, four product concept descriptions were developed. One of the product concepts was an existing product on the market and was used as a benchmark. In the existing product consists of three types of freeze dried fruit that had been marketed in Malaysia recently. These were freeze dried jackfruit, freeze dried banana and freeze dried pineapple. The samples had been send to the researcher by Dr. Salmah Md. Yusof, the lecturer in University Pertanian Malaysia. The four product concept descriptions are shown in Table 6.2.

6.5. PRODUCT PROTOTYPE

Product prototypes were made for each of the four product concept descriptions. The fruits and vegetables such as pumpkin, carrot, kiwifruit and strawberry were processed in the Pilot Plant Laboratory, Department of Food Technology. However, for the apple and the peanuts, the fruits were purchased at the supermarket in Palmerston North. Freeze dried processing was chosen based on consumer preference from the preliminary consumer survey (Chapter 3). The process of freeze drying that was conducted in the Pilot Plant Laboratory is shown in Diagram 6.1.

Table 6.2: Product concept descriptions.

Dried Vegetable Snack.

Introducing new nutritious snack food, the delicious snack food with hot and salting taste that combines Carrot, Peanut, and Pumpkin with all the vitamins, minerals and fiber you need for your day. New nutrition snack food can be used as a snack for leisure, parties, between meals and easy to add in your cooking. The product will be packed in laminated aluminium and plastic packaging that is easy to carry anywhere.

Dried "Kiwi" Fruit Snack.

The new nutritious snack food, the healthy snack with natural taste. The nutrition snack consists of Kiwifruit, Apple, and Strawberry with natural flavour. This snack will be unique variation for use in cooking or as a snack for leisure, parties and between meals. The product will be packaged in laminated aluminium and plastic packaging that is so convenience for you. The new nutritious snack fruit is healthy snack that really tastes great.

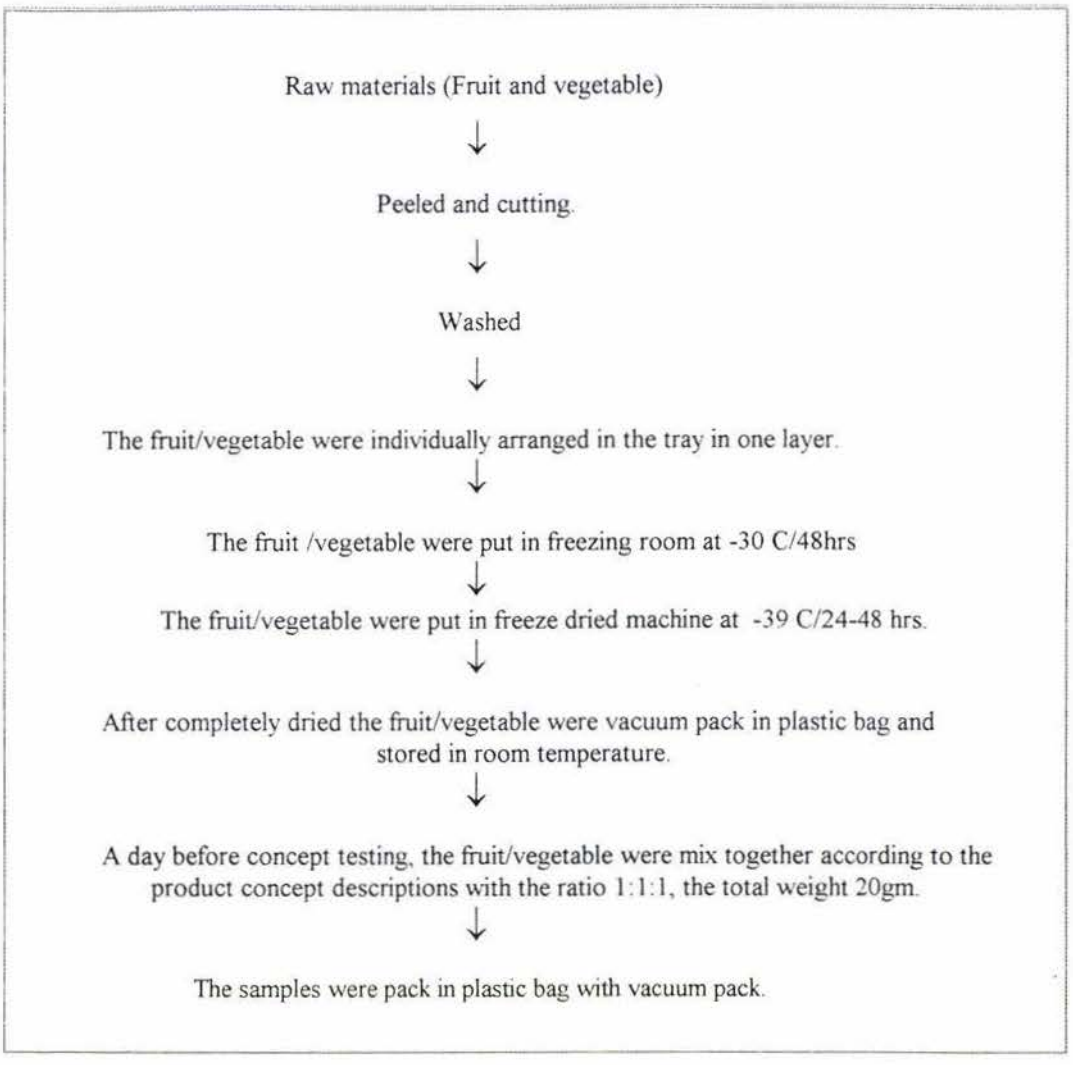
Dried Fruit and Vegetable Snack.

Introducing new nutritious snack, the delightful and nutty-tasting high nutrition snack that combines Apple, Kiwifruit, Carrot and Peanut with its natural flavour. New nutritious snack food will provide you with vitamins, mineral, and fiber you need for your days. A versatile snack food can be used in cooking or served as a snack for leisure, parties and between meals. The product is to be packed in laminated and plastic packaging. With new nutritious snack food, you can have both high nutrition and great taste.

Dried Tropical Snack Fruit.

Introducing new tropical snack food, the delicious and healthy snack food with its own flavour. The tropical snack food will be composed of fruit slices of jackfruit, banana and pineapple. The product is to be packed in laminated aluminium and plastic packaging that easy to carry anywhere. A versatile snack food can be used in cooking or as a snack food for leisure, parties and between meal. With tropical snack food, you can taste the exotic of tropical fruit.

Diagram 6.1: Freeze dried process for product concept prototype.



6.6. EXPERIMENTAL METHOD

6.6.1. Focus group.

Twenty-eight students between the age of 20 to 25 years were chosen for the three focus group sessions. Eight to ten panelists gathered together for each session. In the focus group sessions all the panelists were Malay students. This was because most of the Malay students were flatting together so it was easy to set up an appointment for the sessions. The session were conducted by the researcher and recorded on audio cassette.

The focus group sessions were divided into two stages: discussion of the concept description and the discussion of the prototype discussion. In the first stage, the researcher gave a brief explanation of the purpose of product concept testing and how it was to generate a direction for development of a snack fruit product for the Malaysian market. The panelists were also told that the proposed product was an expensive snack fruit due to the costly process and it can only be base on the fruit and vegetable raw material.

Next, the product concept description and the first set of questionnaires were distributed among the panelists. The panelists were asked to read through all the product concept descriptions. Five to ten minutes were given for panelists to read through the product concept description. Then, the discussion was conducted by the researcher. Appendix 6.4 shows the details of topics discussed in the focus group session . After 30 to 35 minutes of discussion, the panelists were asked to answer the first questionnaire individually. Then, the panelists were given 20 minutes break before proceeding to the second stage of focus group session.

In the second stage, the panelists were given the second set of questionnaires. At the same time, the product concept prototypes were shown to the panelists. The

panelists were given 8 to 10 minutes to look and taste the product prototype. A discussion followed to obtain opinions from the panelists about the product prototypes and its' taste. The second discussion ended in about 40 to 45 minutes. The panelists were then asked to answer the second questionnaire individually.

6.6.2. Survey Method: Semi Self-administrative

Twenty-eight Malaysian students were chosen individually. In this technique, the panelists were given the product concept descriptions and the questionnaire. The panelists were asked to read through the product concept descriptions' first, before answering the first part of the questionnaire.

Once they had finished answering the first part of the questionnaire, the panelists were shown the concept prototypes for 8 to 10 minutes and were asked to taste them. Then, the panelists were asked to answer the second part of the questionnaire. It took about 20 to 25 minutes for the panelists to complete all the questions in the questionnaire. When it completed, the panelists return back the questionnaire to the researcher.

6.7. Results of Product Concept Testing Between Concept Description and Concept Prototype.

The two forms of product concept testing that were tested in this project were product concept description and product concept prototype. Both forms were tested for product concept preference, product attributes, buying intention and purchasing price.

6.7.1. The Product Concept Preference Between the Concept Description and Concept Prototype of Product Concept Testing.

The results of product concept preference in the focus group and the survey method are shown in Table 6.3. Three scores were obtained using each technique; after reading the description, after seeing the sample and tasting the sample

Table 6.3: Product concept preference between two forms of product concept.

	Product concept description (score)	Product prototype: (Sample) (score)	(Testing) (score)
Focus Groups.			
Dried snack vegetable	56	54	40
Dried "Kiwi" fruit snack	72	**92**	69
Dried snack fruit and vegetable	70	75	66
Dried tropical fruit snack	**81**	58	**94**
Survey Method.			
Dried snack vegetable	52	52	34
Dried "Kiwi" fruit snack	**84**	**109**	**96**
Dried snack fruit and vegetable	69	75	62
Dried tropical fruit snack	76	42	89

Note: The Ranking scale was used which no. 4 = the most prefereable, no. 1= less prefereable.

In the focus groups, the dried tropical fruit snack obtained the highest score (81 score) when concept descriptions were shown to the panelists. However, when concept prototypes were shown, the dried "Kiwi" fruit snack was top on the list with a score of 92. The preferences of the panelists changed again when they

tasted the concept prototypes and the dried tropical fruit snack obtained the highest score (94 score) among the panelists.

In the survey method, the dried "Kiwi" fruit snack obtained the highest score from the panelists both before and after the product concept prototypes were shown, and also after the panelists had tasted the product concept prototypes.

6.7.2. The Appearance Preference between Concept Description and Concept Prototype of Product Concept Testing.

From the statistical analysis, there was a significant difference ($p<0.02$) was found in product appearance preference among the panelists when the concept prototypes were shown to them. The results of appearance preference of product concept between concept description and concept prototypes in focus groups are shown in Table 6.4.

Table 6.4: The cross tabulation of product appearance preference between concept description and concept prototype in focus groups.

	CONCEPT PROTOTYPE					
CONCEPT DESCRIPTION	Like very much	Quite like	Neither like nor dislike	Quite dislike	Strongly dislike	Total
Like very much	_	_	_	_	_	_
Quite like	_	3(11%)	2(7%)	_	_	**8(29%)**
Neither like nor dislike	_	**8(29%)**	3(11%)	_	_	11(39%)
Quite dislike	_	3(11%)	4(14%)	_	_	7(25%)
Strongly dislike	_	1(4%)	1(4%)	_	_	2(7%)
Total	_	**15(53%)**	10(36%)	_	_	28(100%)

In the focus groups, 78% of the panelists changed their preference on product concept appearance when the concept prototypes were shown (Figure 6.2). Of the 78% of the panelists 29% changed their preference from "neither like nor dislike" to "quite like" the appearance of product concept.

In Table 6.5. shows the cross tabulation of product appearance preference between concept description and concept prototype in survey method.

Table 6.5: The cross tabulation of product appearance preference between concept description and concept prototype in survey method.

	CONCEPT PROTOTYPE					
CONCEPT DESCRIPTION	Like very much	Quite like	Neither like nor dislike	Quite dislike	Strongly dislike	Total
Like very much	_	_	_	_	_	_
Quite like	3(11%)	**12(43%)**	2(7%)	1(4%)	_	**18(64%)**
Neither like nor dislike	3(11%)	4(14%)	1(4%)	1(4%)	_	9(32%)
Quite dislike	1(4%)	_	_	_	_	1(4%)
Strongly dislike	_	_	_	_	_	_
Total	7(25%)	**16(57%)**	3(11%)	2(7%)	_	28(100%)

In the survey technique, 54% of the panelists changed their preference for product concept appearance (Figure 6.2). It was found that 43% of the panelists "quite liked" the product concept appearance both before and after the product prototypes were shown. The significant difference ($p<0.02$) of preference between concept description and concept prototype in product concept.

Appearance was affected by 25% of the panelists which "like very much" the product concept appearance when the concept prototypes were shown.

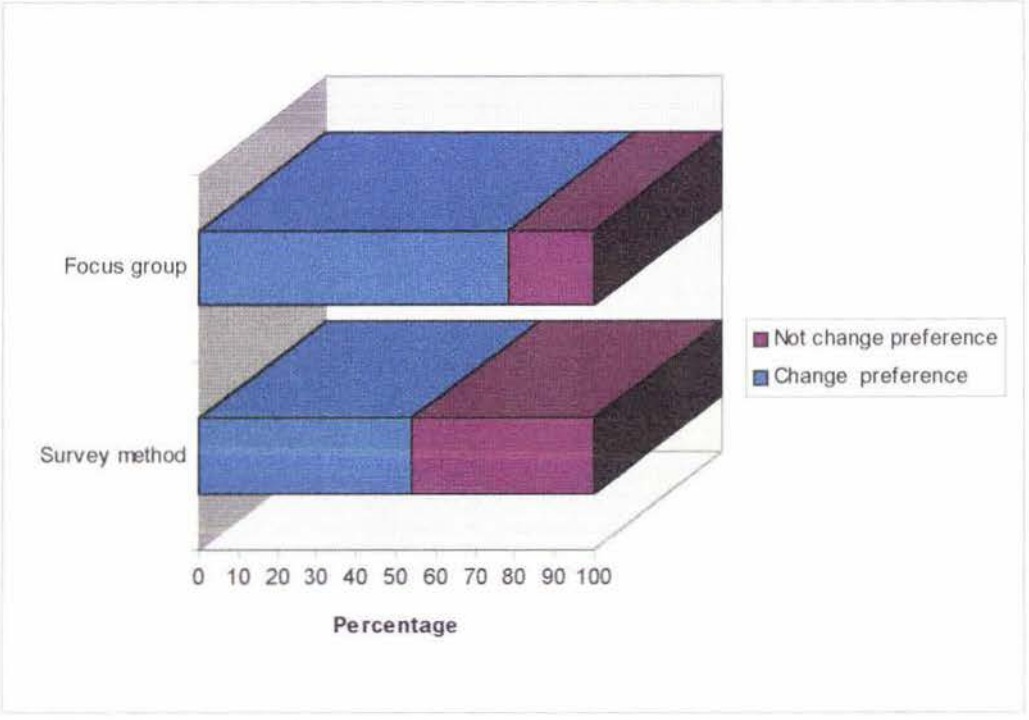


Figure 6.2: The changes of product concept appearance preference when the concept prototypes were shown in focus groups and survey method.

6.7.3. **The Flavour Preference between Concept Description and Concept Prototype of Product Concept Testing.**

There was no significant difference ($p>0.05$) between concept description and concept prototype in product concept flavour preference among the panelists between concept description and concept prototype. The results of product concept flavour preference in the focus groups was showed in Table 6.6.

Table 6.6: The cross tabulation of product flavour preference between concept description and concept prototype in focus groups.

	CONCEPT PROTOTYPE					
CONCEPT DESCRIPTION	Like very much	Quite like	Neither like nor dislike	Quite dislike	Strongly dislike	Total
Like very much	_	_	_	_	_	_
Quite like	3(11%)	**12(43%)**	5(18%)	1(4%)	_	**21(75%)**
Neither like nor dislike	_	3(11%)	1(4%)	_	1(4%)	5(18%)
Quite dislike	1(4%)	1(4%)	_	_	_	2(7%)
Strongly dislike	_	_	_	_	_	0(0%)
Total	4(15%)	**16(57%)**	6(21%)	1(4%)	1(4%)	28(100%)

It was found that in the focus groups 54% of the panelists changed their concept preference and 46% of the panelists did not changed their preference after they taste the product concept prototypes. 43% of the panelists in the focus groups "quite liked" the taste of the product concept before and after they tasted the concept prototype.

Table 6.7. shows the result of panelists preference of product concept flavour in survey method.

Table 6.7: The cross tabulation of product flavour preference between concept description and concept prototype in survey method.

	CONCEPT PROTOTYPE					
CONCEPT DESCRIPTION	Like very much	Quite like	Neither like nor dislike	Quite dislike	Strongly dislike	Total
Like very much	_	_	_	_	_	_
Quite like	2(7%)	**10(36%)**	1(4%)	_	1(4%)	**14(50%)**
Neither like nor dislike	1(4%)	6(21%)	5(18%)	1(4%)	_	13(46%)
Quite dislike	_	1(4%)	_	_	_	1(4%)
Strongly dislike	_	_	_	_	_	_
Total	3(11%)	**17(61%)**	6(21%)	1(4%)	1(4%)	28(100%)

From this study, it was found that 43% of the panelist changed their preference and 54% did not changed their preference after they tasted the product concept prototype. 36%of these panelists "quite liked" the flavour of the product concept when they read the concept descriptions and after they tasted the product prototypes.

6.7.4. **Product Attractiveness Preference between Concept Description and Concept Prototype of Product Concept Testing.**

From the ANOVA analysis for the focus group results a significant difference ($p<0.01$) was found in product attractiveness preference when the product concept prototypes were shown. The product attractiveness preference between concept description and concept prototype is shown Table 6.8.

Table 6.8: The cross tabulation of product attractiveness preference between concept description and concept prototype in focus group.

	CONCEPT PROTOTYPE					
CONCEPT DESCRIPTION	Extremely attractive	Very attractive	Neither attractive nor unatrractive	Very unattractive	Extremely unattractive	Total
Extremely attractive	–	–	–	–	–	–
Very Attractive	3(11%)	4(14%)	1(4%)	3(11%)	–	8(29%)
Neither attractive nor unattractive	1(4%)	**10(36%)**	5(18%)	–	–	**19(68%)**
Very unattractive	–	–	1(4%)	–	–	1(4%)
Extremely unattractive	–	–	–	–	–	–
Total	4(15%)	**14(50%)**	7(25%)	3(11%)	–	28(100%)

In the focus group, 68% of the panelists changed their preference after the product concept prototypes. 36% of these panelists changed their preference from "neither attractive nor unattractive" to "very attractive" when they saw the product concept prototypes.

Table 6.9. showed the product attractiveness preference between concept description and concept prototype in survey method.

Table 6.9: The Cross Tabulation of Product Attractiveness Preference between Concept Description and Concept Prototype in Survey Method.

	CONCEPT PROTOTYPE					
CONCEPT DESCRIPTION	Extremely attractive	Very attractive	Neither attractive nor unatrractive	Very unattractive	Extremely unattractive	Total
Extremely attractive	–	–	–	–	–	–
Very Attractive	2(7%)	1(4%)	–	–	–	3(11%)
Neither attractivr nor unattractive	–	**13(46%)**	5(18%)	–	–	**18(64%)**
Very unattractive	–	2(7%)	4(14%)	1(4%)	–	7(25%)
Extremely unattractive	–	–	–	–	–	–
Total	2(7%)	**16(57%)**	9(32%)	1(4%)	–	28(100%)

In the survey technique, 75% of the panelists changed their preference after concept prototypes were shown (Figure 6.2). 46% of these preference was changed from "neither attractive nor unattractive" to "very attractive".

6.7.5. **Buying Intention Preference between Concept Description and Concept Prototype of Product Concept Testing.**

The buying intention preference between concept description and concept prototype in focus groups in Table 6.10.

Table 6.10: The cross tabulation of buying intention preference between concept description and concept prototype in focus group.

	CONCEPT PROTOTYPE					
CONCEPT DESCRIPTION	Definitely buy	Probably buy	Might buy not buy	Probably buy	Definitely buy	Total
Definitely buy	_	_	_	_	_	_
Probably buy	3(11%)	**9(32%)**	2(7%)	2(7%)	_	**16(57%)**
Might buy or not buy	2(7%)	5(21%)	3(11%)	_	_	11(39%)
Probably not buy	_	_	1(4%)	_	_	1(4%)
Definitely not buy	_	_	_	_	_	_
Total	5(18%)	**14(50%)**	6(21%)	2(7%)	_	28(100%)

From this study, a significant difference was found ($p<0.05$) in the buying intention preference after the product concept prototypes were shown to the focus group panelists.However, 18% of the panelists which would "definitely buy" the product concept after the concept prototypes were shown may contribute to the significance of the result.

In the focus groups, 57% of the panelists changed their buying intention preference after they saw the product prototypes. 21% of these panelists changed their preference from " might buy or might not buy" to "probably buy". However, it was found that 32% of the panelists in the focus groups would "probably buy" the product concept when they read the concept description and after they saw the concept prototypes (Figure 6.3).

In the survey technique, it was found that 50% of the panelists changed their preference. Most the panelists (32%) did not change their preference ("probably buy") when they saw the concept prototypes (Figure 6.3). The significant difference ($p<0.05$) which was found in this data, may affected by 7% of the panelists which "probably buy" the product concept when the concept prototypes were shown (Table 6.11).

Table 6.11: The cross tabulation of buying intention preference between concept description and concept prototype in survey method.

	CONCEPT PROTOTYPE					
CONCEPT DESCRIPTION	Definitely buy	Probably buy	Might buy not buy	Probably not buy	Definitely not buy	Total
Definitely buy	_	_	_	_	_	_
Probably buy	2(7%)	**9(32%)**	_	1(4%)	_	**12(43%)**
Might buy or not buy	_	7(25%)	4(14%)	_	_	11(39%)
Probably not buy	_	1(4%)	2(7%)	1(4%)	_	4(14%)
Definitely not buy	_	_	1(4%)	_	_	1(4%)
Total	2(7%)	**17(61%)**	7(25%)	2(7%)	_	28(100%)

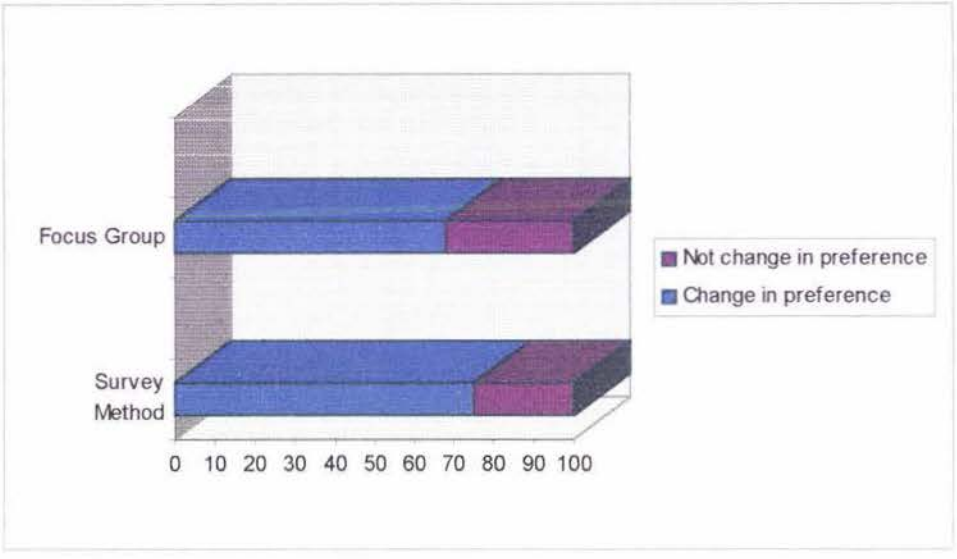


Figure 6.2: The changes of product concept attractiveness preference when the concept prototypes were shown in focus group and survey method.

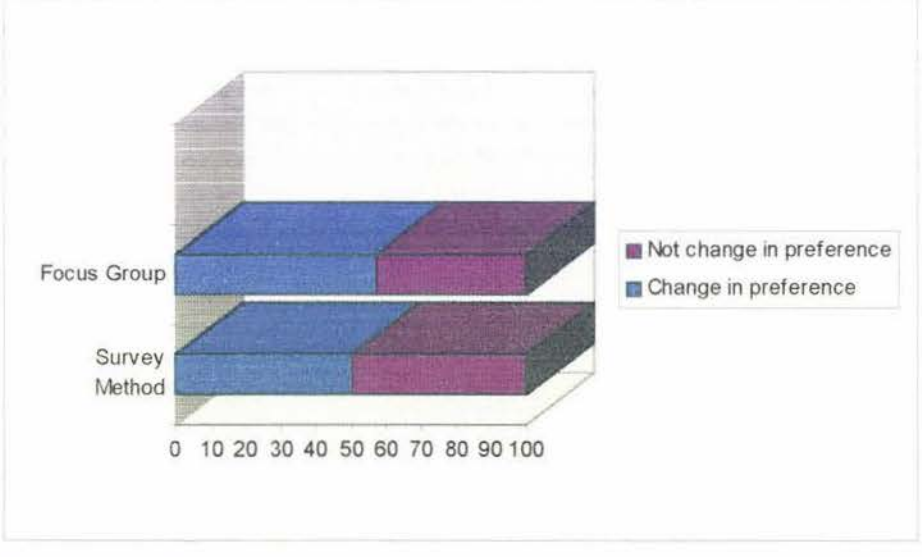


Figure 6.3: The changes of buying intention preference when the concept prototypes were shown in focus groups and survey method.

6.7.6 Relationships Between Buying Intention and Product Attributes Preference in Focus Group and Survey Method.

From the analysis, a positive correlation between buying intention and, appearance, flavour, and attractiveness was found. Of the three product attributes, buying intention had the strongest relationship with product appearance preference (Table 6.13).

Table 6.12:Correlation between buying intention and product attributes preference focus group and survey technique.

	Buying intention
Appearance	0.555
Flavour	0.316
Attractiveness	**0.884**

6.7.7. Purchasing Price Preference between Concept Description and Concept Prototype of the Product Concept Testing.

In the focus groups, about 78% of the panelists did not change their price preference compared to 22% that changed their preference when the product concept prototypes were shown. The same situation was also obtained in the survey technique where 82% of the panelists did not changed their preference after the product concept prototypes were shown (Figure 6.4).

The most preferred price among the panelists in focus group (26%), and in survey method (35%), before and after they saw the product concept prototypes was $3.50 (Appendix 6.5).

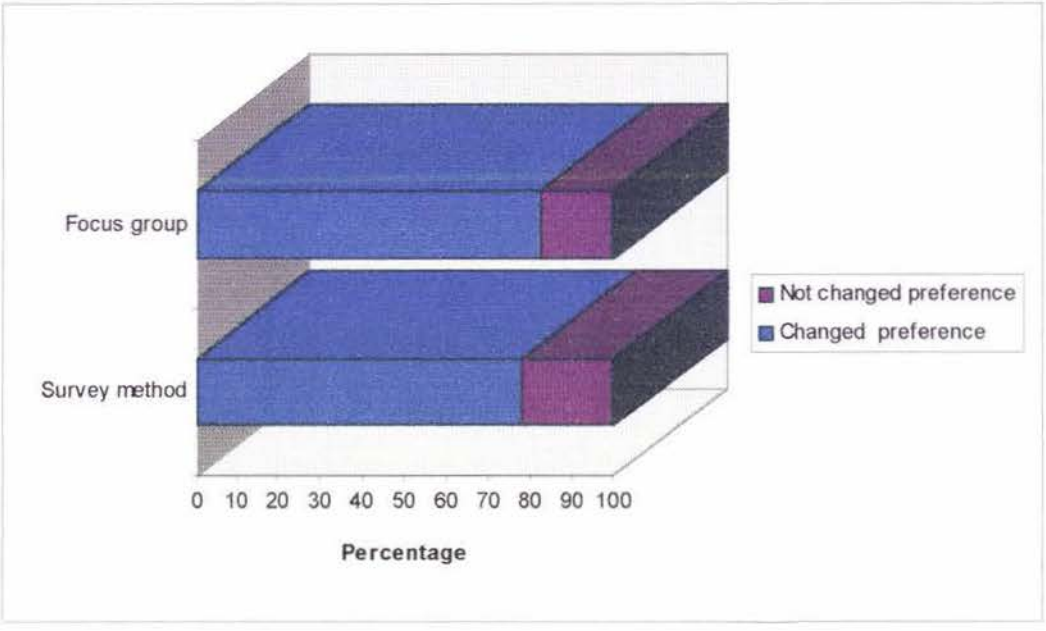


Figure 6.4: Purchase price preference of product concept between concept description and concept prototype.

6.8. RESULTS OF PRODUCT CONCEPT TESTING BETWEEN FOCUS GROUP AND SURVEY METHOD.

In this study two different techniques of product concept were tested: the focus group and the survey technique. Both techniques were used to test product concept preference, product attributes, buying intention and purchasing price.

6.8.1. The Product Concept Preference between the Focus Group and the Survey Technique.

The results of product concept preference between focus group and survey technique is shown in Table 6.13.

Table 6.13: Product concept preference between focus group and survey technique.

	Focus group (score)	Survey technique (score)
Product concept description.		
Dried snack vegetable	56	52
Dried "Kiwi" fruit snack	72	**84**
Dried snack fruit and vegetable	70	69
Dried tropical fruit snack	**81**	76
Product prototype.		
Dried snack vegetable	54	52
Dried "Kiwi" fruit snack	**92**	**109**
Dried snack fruit and vegetable	75	75
Dried tropical fruit snack	58	42
Product prototype testing.		
Dried snack vegetable	40	34
Dried "Kiwi" fruit snack	69	**96**
Dried snack fruit and vegetable	66	62
Dried tropical fruit snack	**94**	89

Note: The Ranking scale was used which no. 4 = the most prefereable, no. 1= less prefereable.

When the panelists read through the product concept description, the dried tropical fruit snack obtained the highest score (81) in the focus groups and the dried "Kiwi" fruit snack (84) in the survey method.

When the concept prototypes were shown, the dried "Kiwi" fruit snack obtained the highest score (81) in focus group and the dried "Kiwi" fruit snack (84) in survey technique. However, when the panelists were asked to taste the product concept prototypes, it was found that the dried tropical fruit snack obtained the highest score in focus group (94) and the dried "Kiwi" fruit snack in survey technique (96).

6.8.2. Product Attributes Preference between the Focus Group and the Survey Technique.

The ANOVA analysis showed that there was no significant difference ($p>0.05$) in product concept appearance preference between the panelists in the focus groups and the survey technique. The same result was also obtained for product concept flavour preference and product concept attractiveness preference (Appendix 6.3).

6.8.2. Buying Intention Preference and Purchasing Price Preference between the Focus Group and the Survey Method of the Product Concept

It was also found that there was no significant difference ($p>0.05$) in buying intention and buying price preference among the panelists between the focus group and survey technique (Appendix 6.3).

6.9. THE TIME REQUIREMENTS AND RELATIVE COST BETWEEN THE FOCUS GROUP AND THE SURVEY METHOD.

The comparison of time requirements and relative cost between the focus group and the survey method is shown in Table 6.14.

Table 6.14. The time requirement and relative cost between the two technique.

	Focus group	Survey method
a. Panelist/session	8-10	1-2
b. Time requirements.		
Time per session	1 1/2 - 2 hours	20 - 25 minutes
Session	3	28
Analysis time	3 - 4 hours/session	6 hours
Total time requirements	**13.5 - 24 hours for 3 days**	**15-16 hours for 5 days**
c. Relative cost		
Refreshment	$10.00 - $20.00 per session	None
Tape cassete	$6.00 per session	None
Research cost	$60.00 per hour	$60.00 per hour
Total cost	**$838.00 - $1478.00 for 3 days.**	**$900.00 - $960.00 for 5 days.**

From this study, it was found that the focus groups required shorter time than the survey method in obtaining data. This was because, in focus groups, eight to ten people come together in one session. In the present study, the researcher took about five days to complete the survey.

For this study, it was assumed that the researcher was paid about $60.00 per hour for one session. In comparing the costs to run the focus group, and the survey method, the sessions in focus group had to be conducted and recorded by the

researcher. This increased the research cost. In addition, some refreshments for the panelists had to be prepared since the session took more than 45 minutes.

The survey method, however had a lower relative cost because full supervision was not necessary, and the panelists answered the questions according to the instructions stated. Furthermore, all the data obtained in survey method were quantitative and so could computed. This reduced the analysis time greatly. In addition, no refreshments were prepared for the interview which only took 20-25 minutes.

6.10. RESULTS OF THE FOCUS GROUP DISCUSSION

The focus group discussion was divided into two sections. First, the results of the discussion when product concept descriptions were shown and second after the product prototypes were shown.

6.10.1. When Concept Descriptions were Used as the Media.

The description of the different variety of fruits and vegetables in the product concept attracted the panelists. Panelists thought that the product was a healthy snack food which has an attractive colour combination and a unique flavour due to the combination of the ingredient. Some of the panelists thought that the product would be similar to a muesli snack bar which is available in the market and the only differences between the product concept and existing product was the ingredient combination and the flavour.

Since the product was an expensive snack food, reasonable in the market and marketed as a healthy snack, panelists thought the suitable target market for this product was an upper class people, the health conscious person, the adventurous,

and university or college students. The panelists believed these target groups had an ability to buy the product. The image of healthy snack food in this product concept would attract such target consumer.

Of all the product concepts, the panelists thought that the taste of the dried snack vegetables and tropical dried snack fruit were suitable for the Malaysian taste buds. This was due to the hot and spicy flavour in the dried snack vegetable and the familiarity of the tropical fruit taste was believed to attract the Malaysian consumer most.

It was thought that the dried tropical fruit snack might be difficult to market as a snack in Malaysia because fruit in the product can be easily obtained in Malaysia at a cheaper price. However, there is still a possible market niche for the dried tropical fruit sold as cooking ingredients or sold as a luxury product with attractive packaging

The panelists believed the dried "Kiwi" fruit snack product concept would have competitive edge on the Malaysia market mainly because fruit such as kiwifruit and strawberry are rare in Malaysia. Moreover, the combination of the dried "Kiwi" fruit snack produced an attractive colour combination which would definitely attract the consumer.

Most of the panelists also commented on the four similar product concepts. The panelists could find any much difference between the four product concepts accept for the tropical dried snack fruit, in which the word "tropical fruit" and "exotic" taste make it quite different from the other product concepts.

6.10.2. When the Concept Prototypes were used as the Media

When the product prototypes were shown, most of the panelists found that the product concepts were very attractive and very different from existing product of dried fruit and vegetable especially since the prototypes still had their natural colour and shape.

Of all the product prototypes, panelists found that the dried snack fruit was the most attractive due to the green and red colour combination of kiwifruit and strawberry. Furthermore, the slices of the apple, kiwifruit and strawberry and the sweet sour taste made the product tempting and irresistible.

For the dried vegetable snack, panelists found that the combination of peanuts with carrots and pumpkin unsuitable due to their shapes and sizes. The panelists also stated that peanut were unsuitable for this product as it was an luxury product but consumer can get dried peanut easily and cheaper. They suggested to choose more expensive nut like cashew nut instead. Panelists also found that the idea of using vegetables as a snack food unsuitable.

Panelists found the dried tropical fruit snack unattractive in colour and shape because all the fruit in this product concept has same colour, yellow, make it look so dull. Furthermore, the shapes of the banana and pineapple did not look so attractive. However, panelists liked the sweet taste of the jackfruit and pineapple in the dried tropical snack fruit and it was believed that the familiarity of the fruit attracted panelists to like the flavour of the dried tropical snack fruit.

There were three factors which make the panelists like the product prototypes: the fruit or vegetables combination that produced an attractive colour combination, the variety of flavour in one product made the product unique, and maintaining

the natural shape of the fruits and vegetables made it different from existing products.

Due to these three factors, the panelists suggested that the product be packed in a box which had a transparent front so the consumer could see the product or in a transparent cylinder jar. The panelists suggested some recommendations of product usage such as a gift or as a breakfast cereal or to serve at a special occasion.

The panelists believed the snack products could be sold in Malaysia, especially the dried "Kiwi" fruit snack, due to its uniqueness of ingredient combination, colour and taste. However in order to make the product marketable, it must have a similar price to other similar competitors' product. Since the production process of this product was expensive it was difficult to reduce the price to below extruded snack food prices, so the panelists suggested to reducing the total weight of the product so it can be sold with the competitors price per unit.

The suggested price by the panelists for this product for 100gm was $3.00 to $5.00. However, according to the panelists this product could only be sold in big supermarkets or in a healthy food shop. This means the product has limited line distribution compared to other product competitor like extruded snack food.

6.11. DISCUSSION OF THE PRODUCT CONCEPT TESTING BETWEEN CONCEPT DESCRIPTION AND CONCEPT PROTOTYPE

The discussion of the product testing between the product concept descriptions and product prototypes was carry out to indicate any significance difference between the two forms on product concept preference, attribute preference, buying intention and buying price.

6.11.1 Product Concept Preference between Product Concept Descriptions and Product Concept Prototypes.

In the focus groups, when the panelists were asked to read the concept description and list down their preference, the dried tropical fruit snack was the most preferable product concept. The familiarity of tropical fruit such as banana, pineapple, and jackfruit consists in this product concept was the reason for the panelists choosing the dried tropical fruit snack, rather than the other product concepts.

However, the panelists changed their preference after the concept prototypes were shown to them and the "Kiwi" dried fruit snack obtained the highest score. The panelists found that the colour combination of strawberry, kiwifruit and apple in the dried "Kiwi" fruit snack gave an attractive colour combination compared with the other concepts prototypes. The panelists found that the dried tropical snack fruit was dull colour combination as all the fruit in it were of a similar colour, yellow.

The familiarity factor, again became the major factor for the panelists to choose the dried tropical snack fruit after they had tasted the concept prototypes. According to the panelists, they chose the dried tropical fruit snack because of the familiarity of the tropical fruit flavour and the sweet taste of the pineapple and jackfruit. The idea of using vegetables as a snack food was so unfamiliar to the panelists, and it therefore obtained the lowest score in product concept preference among the panelists.

In the survey technique, the dried "Kiwi" fruit snack product concept obtained the highest score when panelists read the product concept description, and when the product concept prototypes were shown, and tasted by the panelists. This was because, the panelists thought the fruit combination sounded interesting when

they read the concept description and the product appearance looked so attractive when the concept prototypes were shown and they liked the natural flavour combination of the product concept when they tasted it.

The slight difference of overall product concept preference between panelists in the focus groups and the survey method was probably due to the effects of group discussion which influenced the decision of panelists in the focus groups.

With the focus groups, the dried snack vegetable obtained the lowest score both before and after the product concepts prototypes were shown. This was probably due to the unfamiliarity to the idea of using vegetables as a snack food.

Furthermore, when indicating the food product preference, it was found that familiarisation and the frequency exposure to the particular product were the major influences (Booth, 1985, 1990). From this study, it was found that, the dried tropical fruit snack and the dried "Kiwi" fruit snack were the two preferred product concepts among the panelist when presented with or without the prototypes, because the idea of a dried fruit snack was familiar to the panelist as there are dried fruit snack in the market. Moreover, the fruit that were used in both concepts were more familiar to the panelists than the others.

6.11.2. Product Attributes Preferences between Product Concept Description and Product Prototype.

From this study, a significant difference was found in product concept appearance preference ($p<0.20$) and product concept attractiveness preference ($p<0.01$) when the product concept prototypes were shown. However, no significant difference ($p>0.05$) was found in product concept flavour preference after the product concept prototypes were shown to the panelists.

The changes of product concepts' preference in appearance and attractiveness among the panelists before and after the product concept prototypes were shown were because the panelists thought the product would look like a muesli bar which is commonly available in the market when they read the product concept descriptions. However, when the product concept prototypes were shown, the panelists found that the real products had an attractive fruit colour combination and shape especially the dried "Kiwi" fruit snack that consists of apple,strawberry and kiwifruit.

The panelists found that the product descriptions did not describe the proposed product appearance clearly and interestingly and the product concepts' description were not that different to each other.

From this study, it was show that it made a significant difference to use concept prototypes when indicating the appearance preference and the attractiveness preference of the concepts as these two attributes needed the panelists to visualise the product. Moreover, the lack of ability of the researcher to describe the concepts clearly made the panelists visualise the concepts differently from the actual product. According to Holbert and Speece (1993) when testing for a concept where visualisation is important, it is essential to put the concept into the most elaborate form such as an advertisement or commercial.

In the product concept flavour preference, concept prototypes did not give any significant difference in preference, as it was obvious that this attribute referred to the taste. As the panelists were familiar with the fruit and vegetables that had been used in the product concept testing, they did not have any difficulty to specify the flavour of the product concepts when they read the product concept description.

6.11.3. Buying Intention Preference of Product Concept between Product Concept Description and Product Prototype.

From this study a significant difference ($p<0.05$) was found in the buying intention preference of the product concept among the panelists between the two forms of concept testing. It showed the product concept prototypes presented to the panelists had a significant impact on changes of buying preference of the consumer. As stated by Crawford (1994), comprehensive formats should be presented to the consumer when indicating purchasing intention, and more information should be provided to the consumers for the purchase intention decision.

The changes of buying intention preference among the panelists after the concept prototypes were shown was because the panelists were influenced by the proposed product which had an attractive fruit colour combination and shape, crispy texture, and interesting fruit flavour combination that was clearly described in the product concept description.

From the statistical analysis, it was found that between product appearance, flavour, and attractiveness, product attractiveness had a strong relationship ($r=0.884$) with buying intention preference among the panelists. Therefore the attractiveness of the product concepts was the most important factor for the panelists when determining their buying intention toward the product concept.

6.11.4. Purchasing Price Preference between Product Concept Description and Product Prototype.

It was found that the percentage of panelists who did not change their preference was higher (78% in focus group, 84% in survey method) than the percentage of the panelists who changed their preference (22% in focus group, 16% in survey method) after the product concept prototypes were shown. The most preferable

price for the product concept was $3.50/100gm, both before and after the concept prototypes were shown.

Therefore from this study, it was shown that concept prototypes had negligible effects on the price buying intention. The panelists indicated their price preference by comparing it to existing snack food products in the market and found that a price of more than $3.50 was too expensive for the newly developed snack food product. The panelists also a recommended the researcher to reduce the total weight of the proposed product to less than 50gm as it made the product concept more marketable.

6.12. DISCUSSION OF THE PRODUCT CONCEPT TESTING BETWEEN FOCUS GROUP AND SURVEY METHOD

From the ANOVA analysis, no significant difference ($p>0.05$) was found between the focus group and survey technique in product concept preference, product concept attributes preference, buying intention preference, and buying price preference among the panelists.

Therefore, it was found that the choice of the technique had insignificant effects on consumer preference toward the dried snack fruit concept testing. Both techniques gave similar results on the four criteria tested.

However, the data that was obtained from the focus groups gave more information to the researcher on consumer attitude and behaviour toward the product concepts. This was due to the nature of the focus group method and the open and flexible structure gave the researcher greater scope in the way questions were are phrased or rephrased and it also left the panelists a certain amount of flexibility to respond the question (Goldman and McDonald, 1987).

Moreover, the presence of other panelists in the focus group who question and interacted with one another also helped elicit responses so that were more detailed information could be obtained compared to the survey technique that was rigid by the structured question (Goldman and McDonald, 1987).

The survey method, on the other hand, can provide better statistical estimation results, as Sherak (1966) had used a quantitative form of concept testing to determine how many consumers were favourably disposed towards a new product.

6.13. TIME REQUIREMENT AND RELATIVE COST BETWEEN THE TWO TESCHNIQUES

Table 6.13., shows that in focus groups more people can be gathered at one session for about 1.5 - 2 hours compared to survey method where only one or two people can be interviewed in one session, each session taking 20 to 25 minutes. For the time analysis, the researcher need more time to analyse the information from the focus group session than survey method.

Of the two techniques, the focus groups were more expensive to run than the survey method. This was because the focus group the sessions took more than 45 minutes and refreshments had to be prepared as an incentive for the panelists to go on. Furthermore, the sessions had to be conducted and results recorded by the researcher. This increased the research cost as the researcher has to be paid for the time he/she spent on conducting the session, and the time he/she had to listen to the tape for the analysis.

On the other hand, in the survey method, no refreshment were prepared because each appointment only took about 20-25 minutes and the appointment was usually held on campus. Furthermore, the panelists answered the questionnaire according

to the instructions stated and supervision was unnecessary. This reduced the cost of the survey as trained interviewers were no required. Moreover, the data obtained using this survey method was quantitative and could be computed, which in turn reduced the analysis time

6.14. CONCLUSION

In this study, two forms of product concept testing: concept description and concept prototype were tested to indicate any significant difference between them. It was found from the statistical analysis that there was significant differences between the two forms of the product concept testing on attributes preference such as appearance and attractiveness, and buying intention among the panelists. However, there was no significant difference found on the overall product concept preference and product concept flavour preference.

A high percentage of the panelists changed their preference in product appearance and attractiveness after the product concept prototypes were shown, indicating that concept prototypes had a significant effects on panelists preference on this two attributes. The researcher found that most of the panelists had some difficulty visualising the appearance and the attractiveness of the product just from reading the product concept description. Furthermore, the researcher found that the changes of panelists preference was mostly related to the lack of ability of the researcher to describe the product concept clearly and interestingly.

From this study, it was found that if the objective of the concept testing was to rank a number of new product concepts and to indicate the price preference, product concept prototypes had negligible effects on consumer preference.

No significance difference ($p>0.05$) between the focus group and survey technique on product concept preference, product attributes preference, buying intention, and buying price was found. Of the two techniques, the researcher found that the focus group could provide valuable information about consumers' need and consumers' interactions with the product concept compared to the survey technique. Also, the focus group required less time for data collection, but it cost more than the survey technique.

From this study, it was found that either the focus group or the survey method can be used when testing the product concept for dried snack fruit as both methods gave similar results. However, the limitations of time and cost should be considered before choosing the method of product concept testing. If the developer had a time constraint, it would better to choose the focus group method as it requires less time and more people can gather together at one session. The only disadvantage with using a focus group is the cost of running it. The survey method is relatively cheaper to run but is very time-consuming.

From this study, it was found that the panelists liked the appearance of the dried "Kiwi" fruit snack which consisted of strawberries, apples and kiwifruit.The familiarity of tropical fruit such as banana, pineapple and jackfruit which made up the in dried tropical snack fruit product made the dried tropical fruit snack obtain its highest score in product concept description preference and product concepts prototypes tasting preference. For the product formulation stage, two product concepts (the dried "Kiwi" fruit snack and the dried tropical fruit snack) were chosen for further development.

CHAPTER 7
PRODUCT FORMULATION AND TESTING.

Out of the original four product concepts generated in target, two product concepts namely the dried "Kiwi" fruit snack and the dried tropical fruit snack were selected for further development. They were chosen because they were ranked highest on the preference scale by the panelists in product concept testing. At this stage six fruits: strawberries, kiwifruit, apples, (the "Kiwi" fruit snack) and, bananas, jackfruit and pineapple (the tropical fruit snack) with theirs natural flavour were combined .

A consumer panel test was conducted at this stage where twenty Malaysian students studying at Massey University and Wanganui Polytechnic were chosen. Linear scales were used to evaluate the sensory attributes such as colour, taste, texture, appearance of the ingredient and overall acceptability of the product concepts. To develop an optimum formulation of the product samples, ECHIP programme version 6.04 was used to assist the experimental design.

7.1. AIM AND OBJECTIVES.

The aim of this study was to develop an optimum formulation for a dried snack fruit prototype product using the consumer panel test and systematic experimental design.

The objectives of this study were:

*To develop a product prototype to be tested further in the product development stage.

*To study consumers' performance in the sensory testing of the dried snack fruit.

*To determine any relationship between sensory testing and physical testing.

7.2. EXPERIMENTAL METHODS.

This section is divided into two sections: the preference in package size of the product prototype and the experimental design.

7.2.1. Preference in Package Size.

The basic formulation of the dried snack fruit samples consists of six fruit namely, apple, kiwifruit, strawberry, banana, pineapple and jackfruit. From the focus group sessions which were conducted in product concept testing, the panelists suggested packaging size of the product should be reduced so as to make it more marketable. In order to obtain an acceptable size of the product prototypes, five Malaysian students at Massey University volunteered to help in determining the acceptable product prototype size.

The samples had the total weight of 40gm, 50gm, and 60gm. In these samples only: apple and kiwifruit, were used because they present were in all the formulations with the same proportions.

7.2.2. Experimental Design.

A constrained mixture design was used for this experiment. In the mixture constraint, the independent or controllable variables represented proportionate amounts of the mixture equal to one. The equation of the mixture constraint is shown below:

$$\sum x_i = x_1+x_2.....+x_q = 1.0$$

The formulation used in this project:

constraint (1.0)= strawberry + banana + pineapple + jackfruit

In this study, apple and kiwifruit were held constant at 25% of each for the product prototypes because these fruit were cheap and readily available in New Zealand and this in turn will reduce the total product cost.

The constraints for the four fruit namely strawberry, banana, pineapple and jackfruit were defined. The ranges of the mixture constraint used in this experiment are shown below in Table 7.1.

Table 7.1: Ingredient level used in the mixture design.

	Low level(%)	High level(%)
Strawberry	0	30
Banana	25	50
Pineapple	15	50
Jackfruit	0	15

The ingredient levels of the constraint mixture were obtained based on the cost factor. The proportion of banana and pineapple were larger because these fruit are cheap and through out the year. On the other hand, strawberry had a lower proportion than banana and pineapple because it was a seasonal fruit and its price was quite high compared to the banana and pineapple. As jackfruit, as the fruit

price was expensive because the fruit had to be purchased in Malaysia, it had the smallest proportion compared the others.

Twelve formulations containing these four variables (strawberry, banana, pineapple and jackfruit) were obtained from the ECHIP programme (Table 7.1). Each sample was made as a 40gm sample. The preparation of these samples were described in section 7.3.2.

Table 7.2: Experimental plan for mixture design when kiwifruit and apple were included.

Experimental run	Kiwifruit	Apple	Strawberry	Banana	Pineapple	Jackfruit
1	0.25	0.25	0.12	0.13	0.25	0
2	0.25	0.25	0.15	0.125	0.16	0.065
3	0.25	0.25	0.15	0.125	0.10	0.125
4	0.25	0.25	0.15	0.19	0.16	0
5	0.25	0.25	0.0	0.25	0.25	0
6	0.25	0.25	0.0	0.25	0.125	0.125
7	0.25	0.25	0.75	0.25	0.175	0.0
8	0.25	0.25	0.10	0.20	0.75	0.125
9	0.25	0.25	0.15	0.25	0.75	0.025
10	0.25	0.25	0.0	0.19	0.25	0.0625
11	0.25	0.25	0.0625	0.125	0.25	0.0625
12	0.25	0.25	0	0.125	0.25	0.125

7.3 MATERIAL AND METHOD USED IN THE DRIED SNACK FRUIT PREPARATION

7.3.1. Material.

The processing of dried snack fruit prototypes was carried out on a laboratory scale in the Pilot Plant Laboratory, Department of Food Technology, Massey University. For this study, all the fruits except for the freeze dried jackfruit were purchased at supermarkets around Palmerston North,. The dried jackfruit was imported from Malaysia since fresh jackfruit was not available in New Zealand.

7.3.2. Equipment.

Equipment used in the laboratory scale processing of the dried snack fruit were as followed:

*Freeze dryer (W.G. Cudder Plate Freeze Dried)

*Freezing room

*Steam blancher

*Thermometer

*Stop watch.

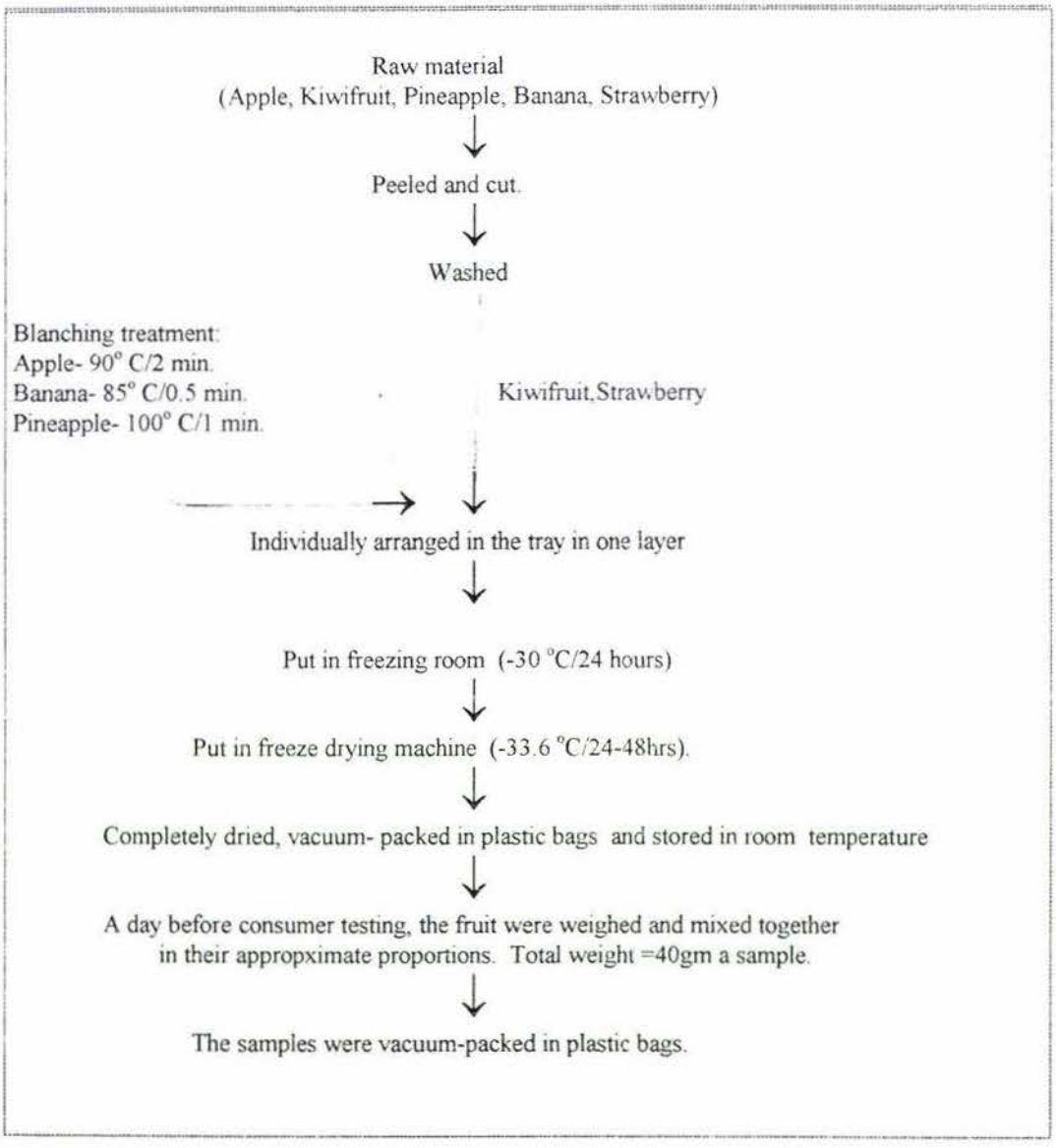
*Tray

The freeze dryer was set up at the temperature of -33.6 °C, the condenser temperature was -31°C and the vacuum pressure was at 5mmHg. The freezing room was at the temperature of -30 °C.

7.3.3. Method.

The dried snack fruit prototype was processed using the method shown in the diagram 7.1.

Diagram 7.1: The processing method for freeze dried snack fruit.



In this process, the blanching treatment was carried out for the apples, banana, and pineapple to prevent any enzymatic browning. The apples were blanched at 90°C for two minutes (Hanson, 1976), the bananas, blanching temperature was 85°C for 30 seconds (Hanson, 1976), and the pineapple, was blanched at 100°C for one minute (Sion and Ishak, 1991).

7.4. **Physical Testing Analysis.**

Physical tests carried out in this study and the following attributes of dried snack fruit samples were measured:

*Texture

*Colour

*Moisture content

*Sugar content

7.4.1. **Texture Testing**

The Instron Universal Testing Machine Model 4500 (Instron Corporation, Italy) was used to measure the hardness freeze dried fruit individually. The hardness was measured as a compression force. A 25 mm diameter `chisel probe' was driven into the sample fruit at a crosshead speed of 10 mm/min and the maximum load was measured. Three replications were carried out for each sample and the average result taken.

7.4.2. **Colour Testing.**

The colour of the sample fruit was measured using the Minolta Chromameter expressed as lightness-darkness (L*), redness-greenness (a*), and yellowness-blueness (b*). The samples were ground and sieved using a 0.5 cm sieve to get a

uniform particle size of the product samples. The colour measurements were done in duplicate and the average data was used.

7.4.3. **Moisture Content.**

The moisture content was determined by weighing approximately 5 gm of the ground sample into an aluminium moisture dish, which had been dried in the drying oven at 100±2°C for twelve hours and cooled for two hours in a dessicator. The moisture dish, lid, and the sample were weighed, done to the 0.0001 g accuracy. Then the moisture dish and the sample were dried in the vacuum oven at 70±1°C under pressure <100 mmHg for seven hours with the lid open. After cooling in a desiccator for two hours, the lid was replaced and the moisture dish with the dried sample were weighed. The weight losses was calculated as the moisture content in percentage. Two replications were conducted and the average data was used (AOAC, 1990).

$$\% \text{ of moisture content} = \frac{\text{initial weight sample - dried weight sample}}{\text{initial weight sample}} \times 100$$

7.4.4. **Sugar Content.**

The Abbe Refractometer was used to measured the sugar content of the sample by weighing 10 gm of ground fruit sample. Eighty-seven percent water that had been lost during the freeze drying process was added to the samples. The samples were filtered through absorbent cotton place in a small funnel. The first few drops were discarded and the next 2 or 3 drops of the filter were placed on the refractometer prism. To determined the reflective index in °Brix, the temperature correction table of refractometers was used because the refractometer was calibrated at 20 °C as usual. Two replicates were analysed for their reflective index and the average taken.

7.5. SENSORY EVALUATION BY CONSUMER PANEL.

Ten Malaysian students from Massey University and ten students from Wanganui Polytechnic were chosen for the sensory evaluation. At the time the sensory evaluation was carried out the summer holidays had started and most of the Malaysian students at Massey University had gone back to Malaysia, therefore, Wanganui Polytechnic students were invited to participate in the testing to obtain the 20 people required.

All the Malaysian participants in this sensory evaluation panel were in New Zealand for less than two years and aged between 20 - 25 years old. The demographic characteristics' of the panel were shown in Table 7.2.

Table 7.3: The demographic characteristics' of the consumer panel testing.

	Massey University (10)	Wanganui Polytechnic (10)
Ethnic: Malay	6(60%)	10(100%)
Non-malay	4(40%)	0(0%)
Gender: Male	7(70%)	5(50%)
Female	3(30%)	5(50%)

7.6. SAMPLE PREPARATION FOR SENSORY EVALUATION.

The product samples were coded with three digit numbers. There were two sets of product samples prepared. The first set of product sample consisted of whole pieces of mixed dried fruit packed in plastic bag and were used to measure colour and appearance

acceptability. The second set of product samples consisted of small pieces of fruit slices in plastic cups and these were used to measure flavour and texture acceptability. The two sets of product samples were prepared because of the small amount of samples available due to the cost and processing constraints of the project.

7.7. QUESTIONNAIRE FOR SENSORY EVALUATION.

The questionnaire for the sensory evaluation consisted of questions related to product sample preference and product sample acceptability. In product sample preference, a descending ranking scale was used where panelists were asked to indicate their preferences on a 6-point scale (6 being the most preferable sample and 1, the least preferable sample).

For product sample acceptability, a line scale with a floating ideal was used. The acceptability test was carried out based on the panelists preference towards colour, taste, texture, appearance and overall acceptability. Two open-ended questions were asked so as to explain the reason why the panelists chose a particular sample as their first choice and one as their last choice (Appendix 7.1).

7.8. CONSUMER PANEL TEST.

The test was conducted in two different places: the Product Development Laboratory, Massey University and the Malaysian Student Hall, Wanganui. This was because the researcher want to make the testing as convenient for the panelists and to reduce the cost of the project.

* Malaysian students at Massey University.

The sensory evaluation was conducted in the Product Development Laboratory, Department of Food Technology, Massey University. The test was done in five session with two panelists in each session. A particular day was set aside for this testing and panelists could choose to come at the time they were available on that day.

*Malaysian students at Wanganui Polytechnic.

The sensory evaluation was conducted at the Malaysian Student's hall at Wanganui. The test was done in five sessions with two panelists in each session. Two particular days were set up for the testing which was carried out only in the morning because most of the panelists were not available after 2.00pm.

The materials for the tests were prepared 15 minutes before the test was conducted and, the materials used in this test were as follows:

*Two sets of product samples: (i)- a packet of the whole pieces of the dried fruit samples.

(ii)- a half cup of small pieces of the dried fruit samples.

* Two sets of questionnaires

*A pencil

*A plastic spoon

*A glass of plain water

*A snacker bars as a gift

7.9. CONSUMER TESTING PROCEDURE.

The procedure of the sensory evaluation was explained to the panelists by the researcher before the testing commenced. Then the panelists were asked to read through the instructions and the questions on the sensory form. The meaning of each attribute term was explained by the researcher to the panelists to avoid any misinterpretation. The panelists were given time to ask the researcher for clarification of the sensory evaluation procedure in case they were unclear about some parts..

Each session of the testing was divided into two parts. In the first part of the session, the panelist was given two sets of six samples for evaluation. Following this, the panelist were given a 15 minute break. Then, in the second part of the session was carried out with another six samples were given to the panelists to be evaluated.

The panelists were asked to rinse their mouth at the begin of the session and between each product sample. The panelists were asked to indicate their ideal score for each attributes and overall acceptability before they went on to indicate the sample score for each product sample. Each session took about 30 to 45 minutes to complete. After the test, the panelists were given snacker bars as reward for their participation.

7.10. DATA PROCESSING AND ANALYSIS OF RESULTS.

Product sample preference was measured according to the total of the sample scores. Then the product samples were ranked from most preferred sample (highest score) to least preferred (lowest score) sample.

The score on the line scale for each sensory attribute and overall acceptability were measured in centimetre, from the zero end of the scale to ten and were termed as 'sample score. The 'ideal sample' score for each attribute was also measured. The 'ratio score' was calculated as the ratio of the 'sample score' to the 'ideal score' for each panelist.

A 'ratio score' greater than one meant that the attribute was greater than the ideal. A 'ratio score' of one indicated that the attribute was 'ideal' and a 'ratio score' less than one meant the attribute was less than ideal. Quattro-Pro version 5.0 was used to calculate the 'ratio scores'.

To obtain an optimum proportion of fruits for the dried snack fruit product, the ratio scores for each attribute obtained from consumer panel test were computed in ECHIP programme. By using the quadratic programme and contour design in the ECHIP programme, an optimum product formulation for dried snack fruit product was obtained.

The data obtained from the sensory evaluation and the physical testing were also analysed for correlation and regression using Minitab programme (version 10.5), and the significant differences between the samples using SAS programme (version 6.0). The detailed result are tabulated as shown in Appendix 7.2.

7.11. RESULTS OF SENSORY EVALUATION IN PRODUCT FORMULATION.

7.11.1 Preference in Package Size.

From the three samples (section 7.2.1), it was found that 40gm net weight of the dried snack fruit product was the most preferred package size among the panelists.

7.11.2. Sensory Evaluation between Two Groups of Malaysian Students: Massey University and Wanganui Polytechnic.

From this study, it was found that there was no significant difference ($p>0.05$) between the two groups of Malaysian students (Massey University and Wanganui Polytechnic) in sensory evaluation for colour, taste, texture, and product sample preference. However, a significant difference ($p<0.05$) was found for fruit mixture and overall acceptability of the fruit product between the two groups of Malaysian students.

This significant difference in the fruit mixture and overall acceptability was due to the lower ideal score obtained from two panelists from Wanganui Polytechnic which resulted in big ratio scores ('outsider' score). After the ratio scores for the fruit mixture of the snack product from panelist number 2, and the ratio score for overall acceptability from panelist number 3 were eliminated, it was found that there was no significant difference ($p>0.05$) between the two groups of Malaysian students for sensory attributes and overall acceptability (Table 7.4). Therefore, the mean ratio scores for the fruit mixture and overall acceptability of the snack fruit product was obtained from nineteen panelists' ratio scores.

As the results showed that there was no significant difference between the two groups of Malaysian students these two groups were treated as one community in the later following discussion.

Table 7.4: The P-values of the appearance and overall acceptability between Malaysian students from Wanganui Polytechnic and Massey University before and after eliminating the 'outsider' scores.

	With 'outsider score'	Without 'outsider' score
Appearance	0.002**	0.303
Overall acceptability	0.008**	0.07

Note:** significantly difference at $p<0.01$

7.11.3. The Product Samples Preference by the Consumer Panel.

The product samples preference by the consumer was shown in Table 7.5.

Table 7.5: The preference of the product samples among the consumer panels.

Product sample	Total Ranking Score
1	73
2	91
3	88
4	69
5	43
6	51
7	61
8	**100**
9	64
10	67
11	65
12	70

For the product sample preference scores, it showed that the product sample 8 obtained the highest score among the Malaysian students while product sample 5 had the lowest.

7.11.4. The Sensory Attributes and Overall Acceptability by the Consumer Panels.

The means ideal ratio scores of sensory attributes and overall acceptability for the dried snack fruit prototype obtained from the consumer testing are shown in Table 7.6.

Table 7.6: The sensory attributes and overall acceptability of the prototypes.

Samples	Colour	Taste	Texture	Fruit mixture	Overall acceptability
1	0.9(0.49)^{abc}	0.8(0.46)^{a}	0.68(0.33)^{a}	0.69(0.3)^{bcd}	0.67(0.32)^{ab}
2	**1.02(0.45)^{a}**	0.85(0.38)^{a}	**0.88(0.39)^{a}**	0.78(0.31)^{abc}	0.74(0.36)^{ab}
3	1.14(0.45)^{a}	0.92(0.43)^{a}	0.71(0.32)^{a}	**0.94(0.3)^{a}**	**0.79(0.35)^{a}**
4	0.7(0.36)^{abc}	0.63(0.32)^{a}	0.76(0.37)^{a}	0.7(0.38)^{bcd}	0.57(0.36)^{ab}
5	0.33(0.26)^{e}	0.72(0.41)^{a}	0.78(0.4)^{a}	0.44(0.3)^{e}	0.50(0.34)^{b}
6	0.47(0.26)^{de}	0.8(0.36)^{a}	0.8(0.37)^{a}	0.45(0.27)^{e}	0.61(0.3)^{ab}
7	0.64(0.29)^{cd}	0.77(0.38)^{a}	0.82(0.33)^{a}	0.6(0.32)^{de}	0.68(0.27)^{ab}
8	**0.98(0.34)^{ab}**	**0.96(1.0)^{a}**	0.83(0.33)^{a}	0.9(0.27)^{ab}	0.77(0.33)^{a}
9	0.86(0.4)^{abc}	0.93(0.54)^{a}	0.14(0.11)^{b}	0.66(0.39)^{cde}	0.72(0.34)^{ab}
10	0.53(0.29)^{de}	0.9(0.47)^{a}	0.82(0.31)^{a}	0.5(0.26)^{ed}	0.69(0.41)^{ab}
11	0.9(0.36)^{abc}	0.89(0.44)^{a}	0.74(0.34)^{a}	0.68(0.3)^{bcd}	0.72(0.34)^{ab}
12	0.64(0.38)^{cd}	0.83(0.32)^{a}	0.65(0.34)^{a}	0.5(0.32)^{ed}	0.56(0.32)^{ab}

Note: The number in parentheses are standard deviation.
Means scores within the column followed by a different letter are significantly different at $p<0.05$.

There was a significant difference in mean ratio scores of overall acceptability ($p<0.05$) among the panelists between the product samples. It was found that product sample 3 was the most acceptable product sample, followed by product sample 8. Product sample 3 was also found to be the most acceptable sample for the fruit mixture.

For colour, the most acceptable sample product were sample 2 and 8. Product sample 8 was also found to have the most acceptable taste. In taste evaluation, there was no significant difference between the product samples.

In texture evaluation, only product sample 9 was found significantly different from the other product samples. However product sample 2 was found to have the most acceptable texture while product sample 9 had the least acceptable texture.

The correlation analysis between the overall acceptability and sensory attributes are shown in Table 7.7. Figure 7.1-7.3 shows the regression plots between the overall acceptability and sensory attributes.

Table 7.7: The r-value between overall acceptability and sensory attributes mean ratio score obtained from consumer panels.

	Overall Acceptability
	r-value
Colour	**0.808**
Taste	0.695
Texture	-0.086
Fruit mixture	**0.784**

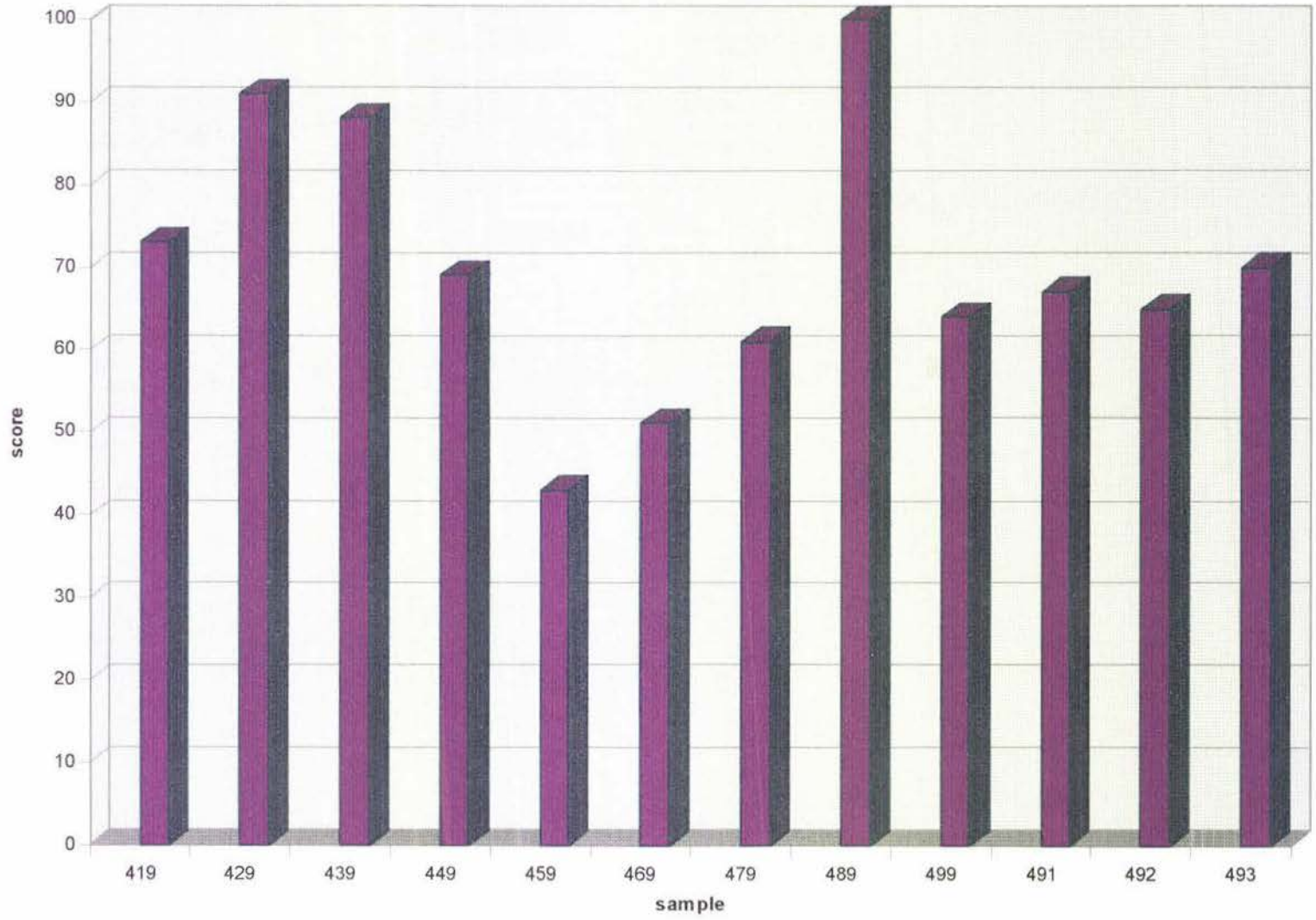


Figure 7.0: Overall acceptability preference

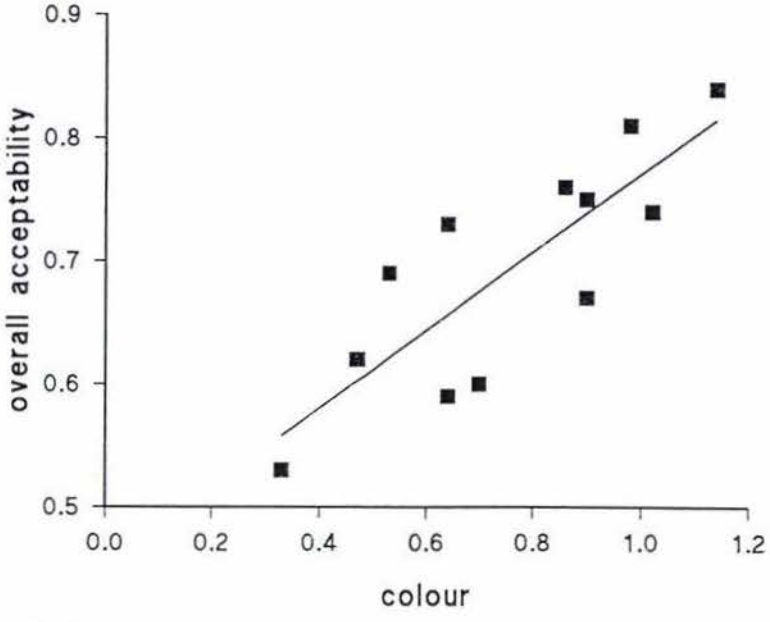


Figure 7.1:Regression plot between colour and overall

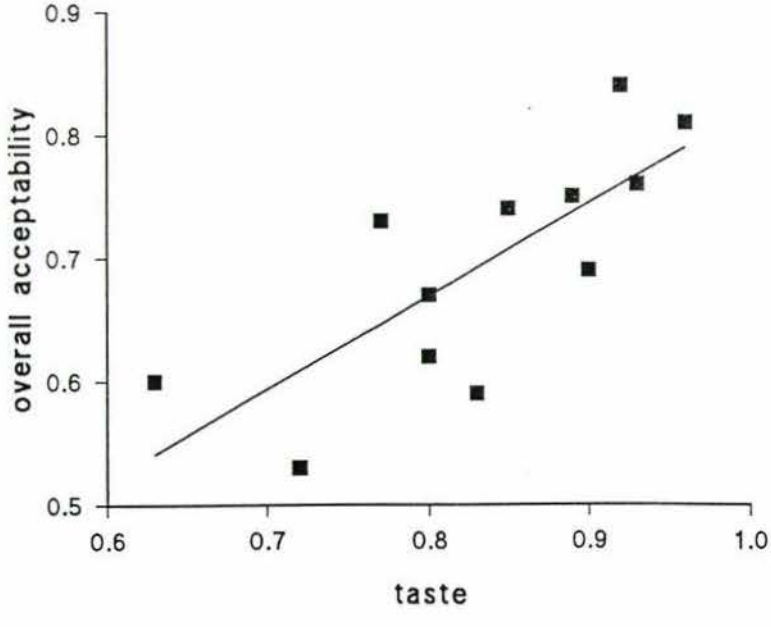


Figure 7.2:Regression plot between taste and overall acceptability

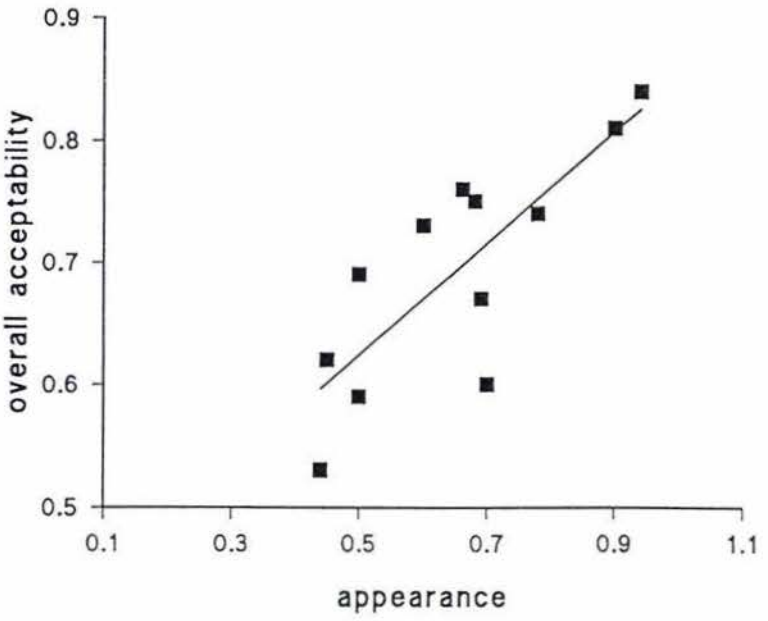


Figure 7.3:Regression plot between apperance and overall acceptability

From Table 7.7 it was found that there was a positive correlation coefficient between overall acceptability and colour, taste, and fruit mixture. A negligible negative correlation was found between overall acceptability and texture evaluation. The attributes, colour and fruit mixture were found to have a strong relation with overall acceptability.

7.12 RESULTS OF PHYSICAL ATTRIBUTES OF PROTOTYPES.

The results of physical tests for the dried snack fruit prototypes are shown in Table 7.8. In colour analysis, there was no significant difference ($p>0.05$) in L* value and a* value between product sample 2 and 8. However, there was a

significant difference ($p<0.05$) between product sample 2 and product sample 8 in b* value. Of the two samples, product sample 8 had the higher b* value than product sample 2.

In sugar content analysis, it was found that the product that score the best for taste was sample 8 which the Brix reading was 9.1° Brix. It was found that there was a significant difference ($p<0.05$) of sugar content between the samples.

From the moisture content analysis, there was no significant difference ($p>0.05$) of moisture content between the samples. The range of percentage moisture present in the dried snack fruit sample was within 1.20% to 1.89%.

Table 7.8: The physical attributes of the prototypes.

Samples	Colour			Sugar content	Moisture content
	L*	a*	b*	(° Brix)	(%)
1	73.21(2.0)^{abc}	9.18(0.21)^{a}	13.87(0.32)^{e}	11.2(1.41)^{abc}	1.698(0.14)^{a}
2	**75.25(2.45)^{abc}**	**10.28(0.12^{ba}**	**16.66(0.28)^{cd}**	11.7(1.41)^{abc}	1.698(0.14)^{a}
3	69.9ed3(0.27)^{c}	8.65(0.01)^{a}	19.07(0.04)^{b}	10.2(4.41)^{abcd}	1.696(0.14)^{a}
4	77.31(1.36)^{abc}	9.43(0.1)^{a}	15.49(0.06)^{de}	9.7(0.00)^{bcd}	1.594(0.005)^{a}
5	77.91(1.77)^{ab}	-0.92(0.14)^{b}	15.4(0.17)^{de}	10.0(0.00)^{cd}	1.097(0.29)^{a}
6	78.52(3.29) ^{ab}	0.06(0.47)^{b}	22.35(0.82)^{a}	8.35(0.71)^{d}	1.198(0.00)^{a}
7	71.44(1.14)^{bc}	7.96(5.78)^{a}	17.64(0.66)^{bc}	10.25(0.35)^{cd}	1.198(0.00)^{a}
8	**72.09(0.91)^{abc}**	**8.55(0.91)^{a}**	**23.42(0.13)^{a}**	**9.1(0.35)^{cd}**	1.892(0.14)^{a}
9	75.02(0.11)^{abc}	7.52(0.23)^{a}	16.41(0.52)^{cd}	10.95(0.35)^{abcd}	1.698(0.14)^{a}
10	79.17(3.18)^{a}	0.31(0.09)^{b}	17.78(0.28)^{bc}	11.7(0.00)^{abc}	1.680(0.42)^{a}
11	75.2(0.66)^{abc}	4.1(0.14)^{ab}	16.61(0.48)^{cd}	13.45(0.35)^{a}	1.298(0.14)^{a}
12	73.94(0.31) ^{abc}	0.010 (0.14)^{b}	21.58(0.63)^{a}	12.45(1.06)a^{b}	1.698(0.42)^{a}

Note: The number in parentheses are standard deviation values.
Mean scores with the column followed by a different letter are significantly difference at $p<0.05$
Number of sample refers to Table 7.2

For texture analysis, the testing was conducted for each individual fruit in the prototypes since it was difficult to indicate the texture of the mixture of the fruit in the product. The result of texture analysis was shown in Table 7.9. From the analysis, it was found that banana was the most hardest fruit in the product sample.

Table 7.9: The texture analysis of prototypes.

	Texture (Newton)
Kiwifruit	9.56
Apple	7.25
Strawberry	8.116
Pineapple	13.94
Banana	**61.87**
Jackfruit	20.21

7.13. EFFECT OF FRUIT PROTOTYPE TO THE SENSORY ATTRIBUTES.

Since kiwifruit and apple were held constant in each formulation, the effect of fruit prototype to sensory attributes was because of the variables of fruit in the mixture constraint: strawberry, banana, pineapple and jackfruit. The correlation between the sensory attributes and fruits in prototypes were shown in Table 7.10.

Table 7.10: Correlation between the sensory attributes and fruits in prototypes.

	Sensory attributes				
Fruit in in the samples	Colour	Taste	Texture	Fruit mixture	Overall acceptability
Strawberry	**0.799**	0.048	-0.185	**0.820**	**0.562**
Banana	-0.612	-0.127	0.312	-0.479	-0.277
Pineapple	-0.435	-0.338	0.311	-0.542	-0.539
Jackfruit	0.239	0.518	0.161	0.216	0.316

From the correlation, it was found that the amount of strawberry in the samples had a very strong relationship with colour and fruit mixture evaluation by the panels. In taste evaluation, only jackfruit had an effect on the taste evaluation by the panels.

The regression equation between sensory attributes and fruits in prototypes were shown in Table 7.11.

Table 7.11: The Regression equation between sensory attributes and fruits in the prototypes.

Regression equation.	R^2 value
Colour = 0.072 strawberry + 0.037 jackfruit - 0.032 banana	89.71%
Fruit mixture = 0.0604 strawberry + 0.034 jackfruit	84.16%

From the regression equation was shown that the increased amount of strawberry and jackfruit would increase the colour and the fruit mixture acceptability of the product sample. On the other hand, the increase amount of banana would decrease the colour acceptability by the panelists.

7.14. RELATIONSHIP BETWEEN PHYSICAL TESTING AND SENSORY ATTRIBUTES.

The correlation between physical testing and sensory attributes is shown in Table 7.12. From the correlation analysis, a good relationships was found between colour and fruit mixture evaluation by panelists with a* value from the physical testing.

Table 7.12: The correlation between physical testing and sensory attributes.

Sensory attributes	Physical testing	Correlation coefficient
Colour	L*	-0.702
	a*	**0.763**
	b*	-0.637
Appearance	L*	-0.654
	a*	**0.829**
	b*	-0.603
Taste	sugar content	-0.0703

The regression equation between physical testing and sensory attributes were shown in Table 7.13.

Table 7.13: The regression equation between physical testing and sensory attributes.

Regression equation	R^2 value
Colour = 0.042 a* value	58.17%
Fruit mixture = 0.0330 a* value	68.77%

From the analysis, it has shown that there was a strong relationships between colour and fruit mixture evaluation by the consumer panels and the a* value. The regression plot between physical testing and sensory attributes is shown in Figure 7.4 and 7.5.

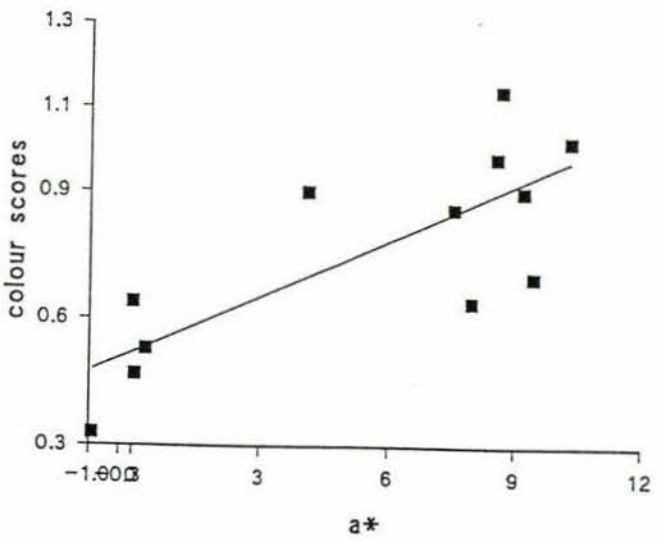


Figure 7.4:Regreesiion plot between a* and colour evaluation

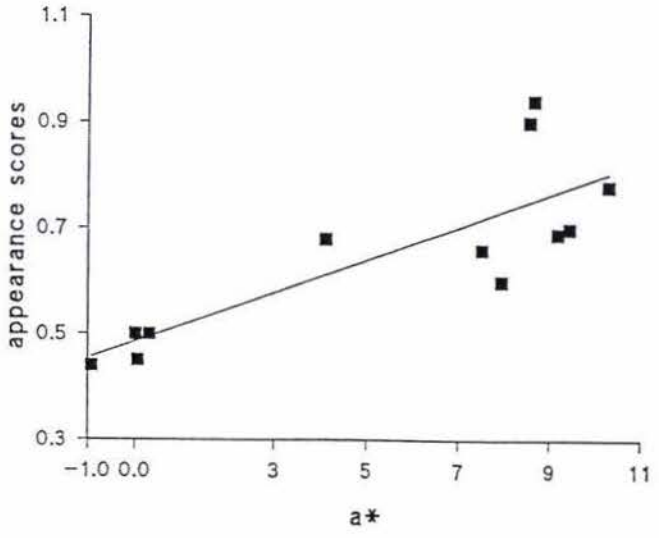


Figure 7.5:Regression between a* and appearance evalaution

7.15. THE PRODUCT OPTIMIZATION.

The purposed of product optimization was to obtain an optimum proportion of fruits of dried snack fruit which was highly acceptable to the target consumer at an optimum price and could compete with the competitor. A strong relationships between overall acceptability and colour attribute in regression analysis was found in this study (section 7.12). This showed that colour attributes was the most affective attributes for the dried snack fruit product.

From sensory attributes, three product samples: sample 2, 3, and 8 were found to be the most acceptable product samples in overall acceptability and sensory attributes. Based on the ingredients levels of these three samples (Table 7.14), the upper and lower limit of optimum formulation for dried snack fruit was obtained (Table 7.15)

Table 7.14: The percentage of fruits in sample 2,3 and 8.

Sample	Fruit	Ingredient level (%)
2	Strawberry	30
	Banana	25
	Pineapple	32.5
	Jackfruit	12.2
3	Strawberry	30
	Banana	25
	Pineapple	20
	Jackfruit	25
8	Strawberry	20
	Banana	40
	Pineapple	15
	Jackfruit	25

Table 7.15: The upper and lower limit of mixture constraints.

	Lower limit (%)	Upper limit (%)
Banana	25	50
Pineapple	15	50
Strawberry	20	30
Jackfruit	12	25

By using contour design in ECHIP programme, an optimum product formulation was obtained (Figure 7.6).

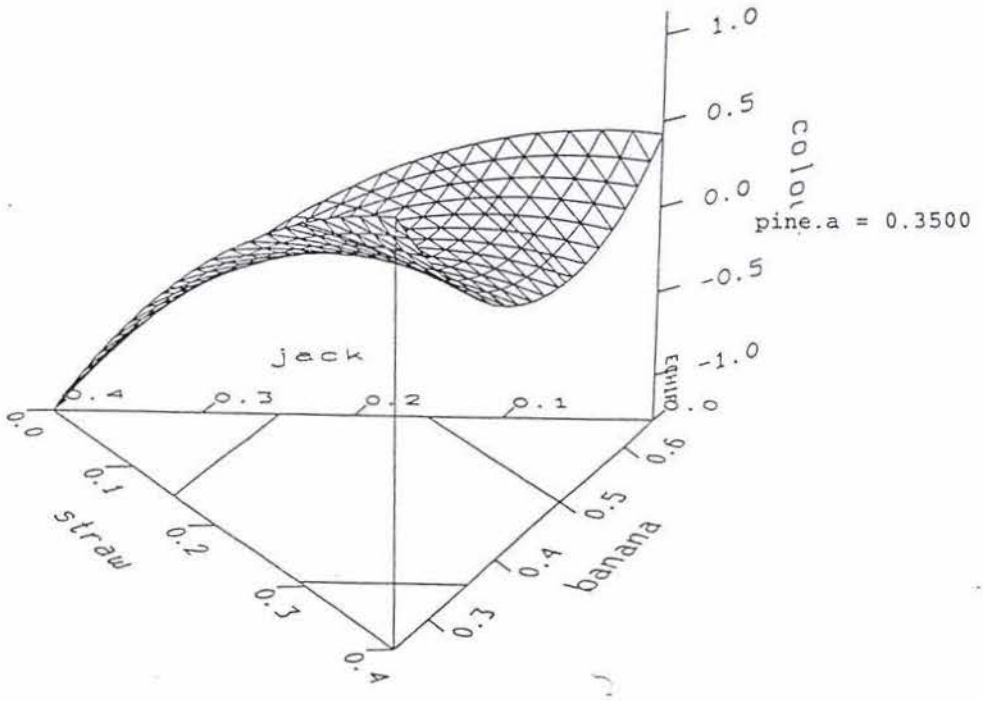


Figure 7.6: The contour plot for the product formulation.

The contour plot showed that the increased of strawberry would increased the colour acceptability of the panelists and the decreased of banana in the formulation would increased the acceptability of the sample. The pineapple was held constant because from the regression equation showed that pineapple did not have any relationships with colour acceptability by the panelists (see Table 7.11). The regression equation between colour and mixture constraints was shown below:

colour = 0.29strawberry + 0.88 jackfruit - 0.33 banana	R^2 value= 93.6%

An optimum formulation for the dried snack fruit prototype obtained from ECHIP programme was shown in Table 7.16.

Table 7.16: An optimum formulation for the dried snack fruit.

Mixture constraints:		Continuos variables:	
Strawberry	25%	Apple	50%
Banana	26%	Kiwifruit	50%
Jackfruit	14%		
Pineapple	35%		
Total	100%		100%

7.16. AN APPROXIMATE COSTING OF DRIED SNACK FRUIT.

An approximate cost of manufacturing the dried snack fruit product was based on the cost system of local manufacturing in Malaysia which included the cost of raw materials, processing, packaging and overheads (Table 7.17). In this study, this data information was used for calculating the dried snack fruit approximate cost.

Table 7.17:The percentage of approximate costs to manufacture dried snack fruit.

	(%)
a. Raw materials.	23
b. Freeze drying	49
c. Packaging	2
d. Overheads cost	26
Total	**100%**

From the market information (Appendix 1.0), market price of freeze dried snack fruit in Malaysia was $0.74/25gm (RM1.25/25gm), as for 40gm the price was $1.18(RM3.40). The assumption of miscellaneous cost for the existing product was 15%, therefore the product cost was $1.00/40gm (RM2.89/40gm). An approximate product cost of existing dried snack fruit is shown in Table 7.18.

Table 7.18: An Approximate Costing of Dried Snack Fruit.

	$/40gm	RM/40gm	(%)
a. Raw material	0.14	0.66	23
b. Freeze drying	0.31	1.42	49
c. Packaging	0.013	0.06	2
d. Overhead cost	0.16	0.75	26
Total	1.00	2.89	100

Note: $1.00= RM1.70

7.17. DISCUSSION OF PRODUCT FORMULATION IN THIS PROJECT.

7.17.1 Sensory Attributes Acceptability of Dried Snack Fruit.

The analysis of two groups of Malaysian students at Massey University and Wanganui Polytechnic indicated that there was no significant difference ($p>0.05$) in sensory attributes acceptability except for appearance and overall acceptability. The significant difference in appearance and overall acceptability was due to the lower ideal scores in fruit mixture and overall acceptability given by the two students from Wanganui Polytechnic which resulted in "outsider" scores for both attributes which not fit in the data.

The "outsider" score was also found in a study on the development of a glue stick for Thailand market (Uaphitak,1994). Several ways were suggested to overcome this problem. Firstly, by transforming the ratio scores to logarithms of the ideal score (Wiriyacharee, 1991). Secondly, by indicating ideal scores for each attribute before the sensory testing was conducted (Wan, 1987). For this study, the ratio scores of these of two students from Wanganui Polytechnic were eliminated from the mean ratio scores of appearance and overall acceptability.

As a floating ideal was used in this study, it was found that there was a large variation on the scale and ratio. Uaphitak (1991) also found a similar restriction when a floating ideal was used. One of the disadvantages of using floating ideals in sensory evaluation is that panelists tend to use different parts of the scales and the ratio values vary greatly (Uaphitak, 1991).

Overall, two groups of Malaysian students, Massey University and Wanganui Polytechnic, can be treated as one community for the future discussion. Since no significant difference was found between the two groups in sensory evaluation.

7.17.2 Sensory Attributes of the Product Samples Evaluated by Consumer Panel.

The results from the consumers panels showed that all the prototypes were accepted by the consumers as the means ratio scores for the overall acceptability for all the product samples ranged from 0.5 to 0.79 (see Table 7.5).

Colour had a strong relationship (r=0.808) with overall acceptability. Followed by fruit mixture (r=0.784) and taste (r=0.695). This showed that the most affective attribute for the acceptability of dried snack fruit was colour because the product consisted of a variety of fruit which produced a variety of colour particularly, strawberry (r=0.799). Two product samples obtained the ideal ratio score in colour evaluation which were product sample 2 (1.02) and product sample 8 (0.98).

The most acceptable product sample according to the panelists was product sample 3 and the least acceptable product sample was product sample 5. Product sample 3 consisted of 30% of strawberry, 25% each of jackfruit and banana, 20% of pineapple. On the contrary, product sample 5 which only consisted of 50% of pineapple and banana was the least acceptable sample.

This showed that the amount of strawberry and jackfruit in the sample had a significant effect on the acceptability of the product samples. This result agrees with the regression analysis between sensory evaluation and dried fruit prototypes. Between strawberry and jackfruit, strawberry had a strong relationship with colour, and fruit mixture. This showed that increased amounts of strawberry would increase the acceptability of the product sample.

The correlation analysis showed a negligible negative correlation coefficient between overall acceptability and texture evaluation. This showed that the acceptability of the product sample was not affected by the texture of the fruit in the sample. Furthermore, the correlation analysis showed that there were no relationships found between texture evaluation and type of fruits in prototype. The results showed that there was no dominant fruit which significantly affected the acceptability of the product sample texture.

7.17.3. **Relationship between Physical Tests and Sensory Attributes.**

In this study, colour physical tests had a good relationships with sensory attributes such as colour and fruit mixture evaluation from the consumer panel (r-value between -0.654 to 0.829). According to Moskowitz (1983) a good correlation between sensory level and physical level normally fall between 0.5 to 0.7. Between L*value, a*value and b*value, it was found that a* value had a strong relationship with colour (r=0.763) and with the fruit mixture (r=0.829) evaluation by the panelists.

In colour testing, the highest a* value was obtained from product sample 2 which consisted 30% strawberry and product sample 5 had the lowest a* value which did not contain any strawberry. The results from colour evaluation showed that product sample 2 was most acceptable and product sample 5 was least acceptable. This showed that the amount of red colour in the product sample had a significant effect on the acceptability of the product samples according to the panelists.

There was negative correlation coefficient between b* value and colour acceptability by the consumer (r=-0.637) and also with appearance acceptability (r=-0.603). This showed that increased amounts of banana and pineapple which gave a significant yellowness in the sample, will decreased the colour and appearance acceptability according to the panelists.

A negligible negative correlation coefficient (r=-0.073) was found between taste evaluation by the panelists and the sugar content of the sample product. In this study refractometry measurements did not have a good correlation with sensory

scores. This may be due to the poor sensitivity of the refractometer (Amerine et al, 1965) when measuring the sweetness of the dried snack fruit compared to the sensory measurements.

7.18. **CONCLUSION.**

From the sensory evaluation, it was found that the main attributes for developing the dried snack fruit product was colour combination and the fruit mixture of the product sample for both attributes acceptability was significantly affected by amount of the strawberry in the samples. In the relationship between sensory testing and physical testing, only colour testing had a good correlation with sensory evaluation: colour and appearance acceptability, and a* value gave a significant effect on the acceptability of colour and appearance. This showed that increased redness of the sample may increase the acceptability of the product sample.

By using the ECHIP programme and the input of ratio scores from the sensory evaluation, an optimum formulation of dried snack fruit was obtained. This prototype has the following formulation:

Apple	25%
Jackfruit	25%
Strawberry	13%
Banana	17.5%
Pineapple	12.5%
Jackfruit	7%
Total	100%

In the next stage, the formulated prototype will be finally tested by the Malaysian students at Massey University to measure the product acceptability among the Malaysian students.

CHAPTER 8
FINAL CONSUMER TESTING OF PRODUCT

In the previous chapter, the dried snack fruit was developed and tested with a small consumer panel. At this stage of the project, the prototype was made in pilot scale production and was tested with the target consumers to see how consumers reacted to the product to indicate its potential acceptance in the marketplace. The product was tested with sixty-four Malaysia students at Massey University from various faculties.

8.1. AIM AND OBJECTIVES.

The aim of this study was to measure the product acceptability of dried snack fruit among the Malaysian students studying at Massey University.

The objectives were to:

* To determine the acceptability of product attributes of dried snack fruit.
* To determine the pattern of product usage among the Malaysian students.
* To determine consumer purchase intention and acceptable price for the dried snack fruit.
* To indicate market potential for dried snack fruit among the Malaysian students at Massey University.

8.2. SAMPLE.

The consumer testing was conducted amongst sixty-four Malaysian students from various faculties at Massey University. The target consumers were not divided into their ethnic groups in this testing as previous testing had show this to be

unnecessary. Sixty-five percent of the respondents were Malaysian students who studied at Massey University for more than a year but had just coming back from Malaysia for three months Summer Holiday and 35% of the respondents were a new Malaysian students at Massey University. Ninety-eight percent of the respondents were snackers. Table 8.1 shows the demographics characteristics' of the population in consumer testing.

Table 8.1. The demographics characteristics' of the population in consumer testing.

	No. Response	Percentage
Ethnic: Malay	47	73%
Non-Malay	17	27%
Sex: Male	31	48%
Female	33	52%
Age(years): 18-20	2	3%
21-24	52	81%
25-30	9	14%
Over 30	1	1%

8.3. QUESTIONNAIRE.

The questionnaire for the consumer testing was composed of questions relating to the acceptability of the product attributes, snacking pattern, price, buying frequency, and buying intention. There was an open-ended question on the price the consumers would buy the product. The questionnaire used in the consumer testing is shown in Appendix 8.1.

8.4. SAMPLE PREPARATION.

The dried snack fruit samples were packed in laminated aluminium packaging that were available in the Pilot Plant Laboratory, Department of Food Technology, Massey University. The cover of the packaging has been designed by Art and Graphic students, Wanganui Polytechnique. The brand name and information about the dried snack fruit were printed on the packaging (Figure 8.1). The sample was 40gm in net weight.

8.5. TESTING OF THE PRODUCT.

In this project, in-house product testing was carry out toward the target consumers. The questionnaire and product samples were delivered to the respondent's house by the researcher. The respondents were ask to taste the product sample and fill out the questionnaire, over approximately three to four days then return it back.

Figure 8.1: The appearance of the dried snack fruit packaging

8.6. DATA PROCESSING AND ANALYSIS OF RESULTS.

The data obtained from the consumer testing were processed by the computer. The Minitab version 10.5 was use for the analysis. Data was analysed by its' correlation using the Pearson Correlation and regression. Questions that the respondents did not answer were termed "non-response".The detailed results are tabulated as shown in Appendix 8.2.

8.7. THE RESULT OF CONSUMER TESTING.

8.7.1. Consumer Acceptability of the Dried Snack Fruit.

To determine the consumer acceptability, the respondents were asked to indicate their like/dislike of the dried snack fruit flavour, fruit colour combination and overall acceptability. The results of the consumer acceptability of dried snack fruit were shown in Table 8.2.

For the flavour acceptability, 71% of the respondents liked the flavour of the dried snack fruit sample. About 11% of the respondents disliked the flavour of the prototype. For the colour acceptability, most of the Malaysian students (83%) liked the colour combination of the prototype compared to only 6% of them disliking the colour combination of the prototype.

In overall acceptability, most of the respondent (69%) indicate that they liked the product sample. 20% of the respondents found that they "neither like nor dislike" the dried snack fruit sample. About 11% of the respondents disliked the dried fruit snack sample.

Table 8.2: The Consumer Acceptability of Dried Snack Fruit.

	No. of Respondents	Percentage
a). Flavour like/dislike.		
Like extremely	16	(25%)
Like moderately	**30**	**(46%)**
Neither like nor dislike	12	(18%)
Dislike moderately	7	(10%)
Dislike extremely	1	(1%)
b). Colour combination like/dislike.		
Like extremely	12	(19%)
Like moderately	**41**	**(64%)**
Neither like nor dislike	7	(11%)
Dislike moderately	3	(5%)
Dislike extremely	1	(1%)
c). **Overall acceptability.**		
Like extremely	11	(17%)
Like moderately	**33**	**(52%)**
Neither like nor dislike	13	(20%)
Dislike moderately	3	(5%)
Dislike extremely	4	(6%)

The statistical analysis showed that there was positive correlation coefficient between flavour liking and overall acceptability (r = 0.949), and between colour combination liking and overall acceptability (r = 0.976)(Figure 8.2 and Figure 8.3).

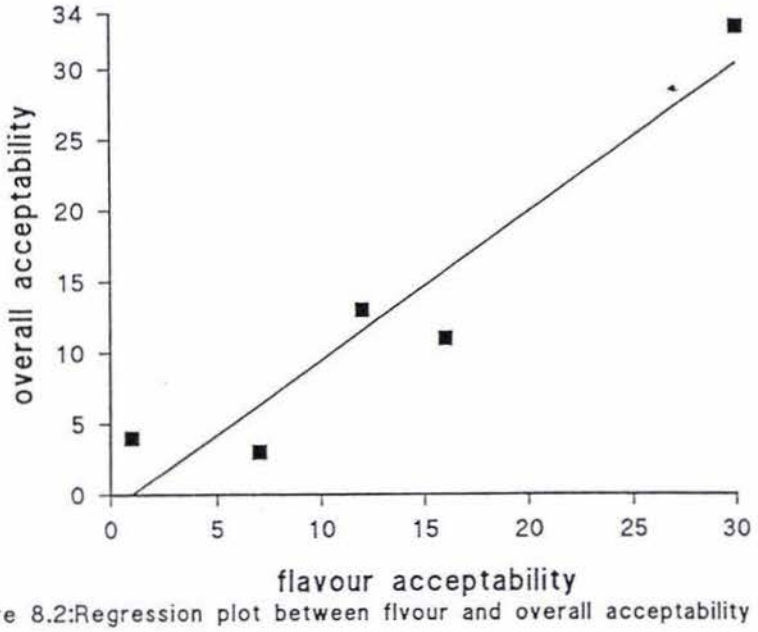


Figure 8.2:Regression plot between flvour and overall acceptability

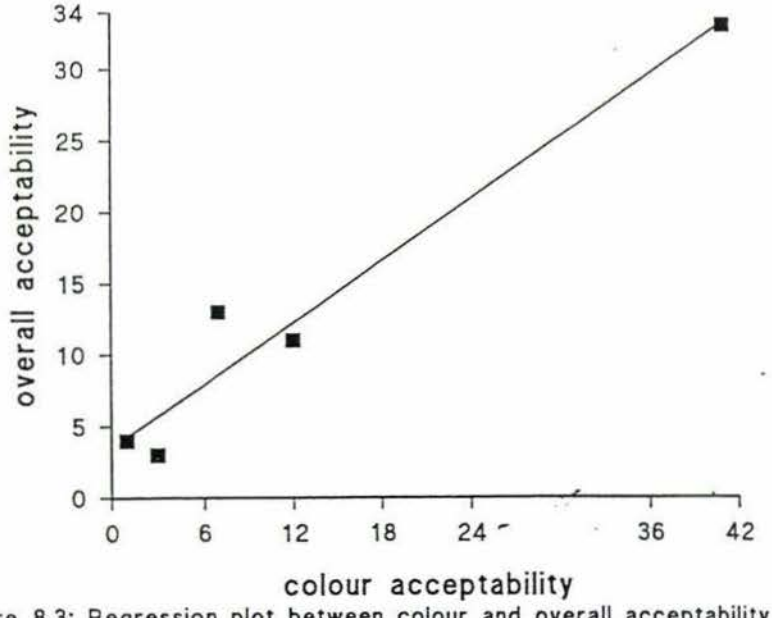


Figure 8.3: Regression plot between colour and overall acceptability

8.7.2. **Price of Dried Snack Fruit.**

The maximum price the respondents were prepared to buy the dried snack fruit sample was shown in Table 8.3.

Table 8.3: The maximum price for the dried snack fruit.

	No. of Respondents.	Percentage
$5.50(RM9.35)	0	(0%)
$5.00(RM8.50)	1	(1%)
$4.50(RM7.65)	4	(6%)
$3.50(RM5.95)	10	(16%)
$3.00(RM5.10)	18	(28%)
$2.50(RM4.25)	**31**	**(48%)**

Majority of the respondents (48%) were prepared to buy the dried snack fruit sample at the price of $2.50/40gm. About 28% of the respondents were prepared to buy the product sample at the maximum price of $3.00/40gm and only 1% of the respondent was prepared to buy the product sample at the maximum price of $5.00/gm.

When the respondents were asked to indicate their preferred price for the dried fruit snack sample, it was found that the range of the proposed price by the respondents was from $1.00/40gm to $5.00/40gm. (Figure 8.4). The four most proposed prices that respondents would like to pay for the dried snack fruit

sample in descending order were as followed: $2.50/40gm.(31%), $2.00/40gm (24%), $3.00/40gm (12%) and $3.50/40gm (7%).

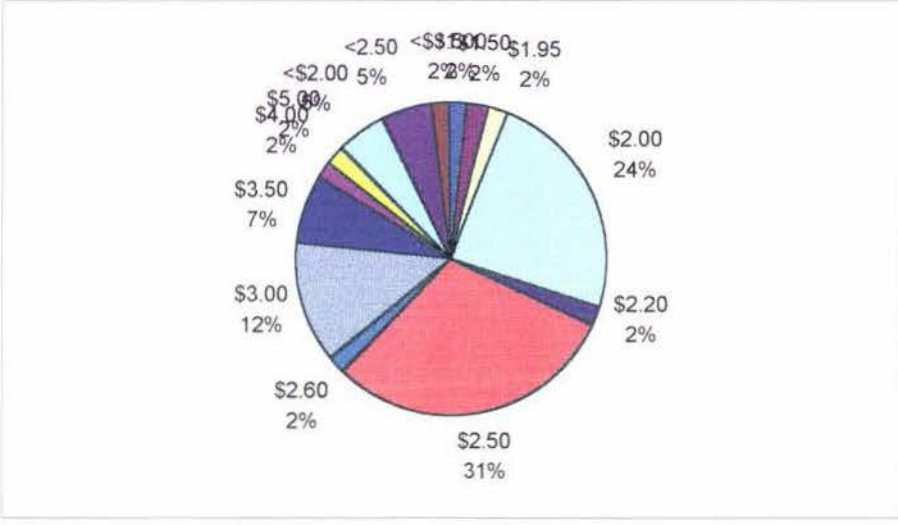


Figure 8.4: The chart of the proposed price the respondents would like to pay for the dried snack fruit at the weight of 40gm net.

8.7.3. **The Purchase Intention of Dried Snack Fruit Sample.**

The percentage of purchase intention of dried snack fruit sample among the respondents at the price of $2.50/40gm was shown in Table 8.4. Most of the respondents (68%) were interested in buying the dried fruit snack sample at the price of $2.50/40gm. and 14% of the respondents they were not interested. About 18% of the respondents were "neither interested nor not interested" to the dried snack fruit at the price of $2.50/40gm.

Table 8.4: The purchase intention of the dried snack fruit at the price of $2.50/40gm.

	No. of Respondents.	Percentage
Very interested.	15	(23%)
Moderate interested.	**29**	**(45%)**
Neither interested nor not interested.	12	(18%)
Moderate not interested.	3	(5%)
Very not interested.	5	(9%)

8.7.4. **The Pattern of Dried Snack Fruit Usage of the Consumer.**

The pattern of dried fruit snack usage by the respondents were shown in Table 8.5.

Table 8.5: The usage pattern of the dried fruit snack.

	No. of Respondents.	Percentage
As a dessert	15	(14%)
As a breakfast cereal	20	(19%)
In cooking	0	(0%)
Between the meal	26	(24%)
Parties	**28**	**(26%)**
Serve on the special occasion	9	(8%)
While watching tv/movie	3	(3%)
Picnic	1	(1%)
When wanted to taste something new.	5	(5%)

From this study, it was found that 26% of the respondents would eat the dried snack fruit at parties. About 19% of the respondents would eat the product sample as a breakfast cereal and 14% of the respondents would eat the dried snack fruit as a dessert. None of the respondents would use the dried snack fruit in cooking.

8.7.5. **Frequency of Buying Pattern of Dried Snack Fruit.**

The frequency of buying pattern of dried fruit snack at the price of $2.50/40gm among the respondents was shown in Table 8.6.

Table 8.6: Frequency of buying pattern of the dried snack fruit.

	No. of Respondents.	Percentage
More than once a week	11	(20%)
Once a week	**13**	**(24%)**
Once a fortnight	**13**	**(24%)**
Once a month	**13**	**(24%)**
Less than once a month	5	(9%)

At the price of $2.50/40gm, 24% of the respondents would buy the dried snack fruit at once a week, once a fortnight and once a month. About 20% of the respondents would buy the product sample more than once a week and only 9% of the respondents would buy the dried snack fruit less than once a month at the price of $2.50/40gm.

8.7.6. **Consumer Buying Intention.**

The percentage of buying intention among the respondents were shown in Table 8.7.

Table 8.7: Consumer buying intention.

	No. of Respondents.	Percentage
Definitely buy	15	(27%)
Probably buy	**28**	**(50%)**
Might buy or might not buy	12	(21%)
Probably not buy	1	(2%)
Definitely not buy	0	(0%)

Most of the respondents (77%) would buy the dried fruit snack if it was available at their supermarket. About 21% of the respondents "might buy or might not buy" the product and only 2% of the respondents would not buy the product sample if it was available at their supermarket.

The statistical analysis showed that there was positive correlation coefficient between buying intention and overall acceptability ($r = 0.957$) and between buying intention and purchase intention ($r = 0.988$) (see Figures 8.5 and 8.6).

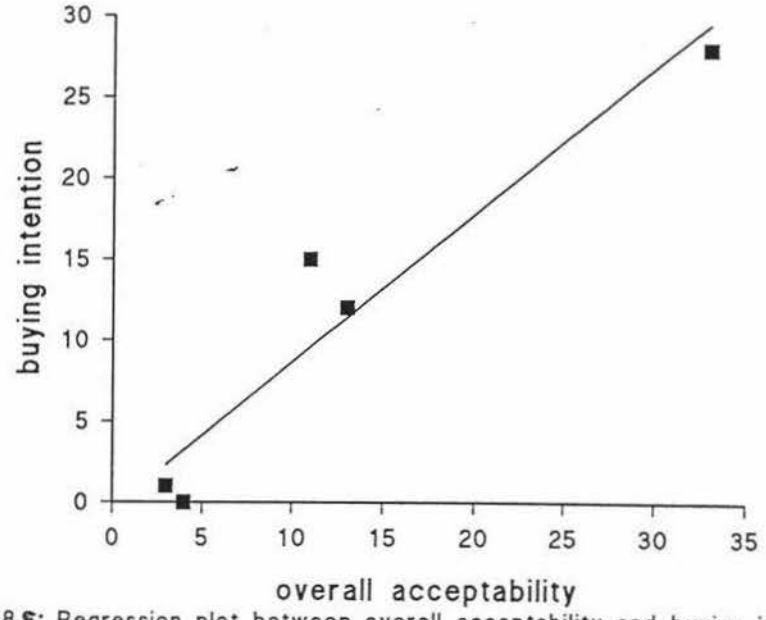


Figure 85: Regression plot between overall acceptability and buying intention

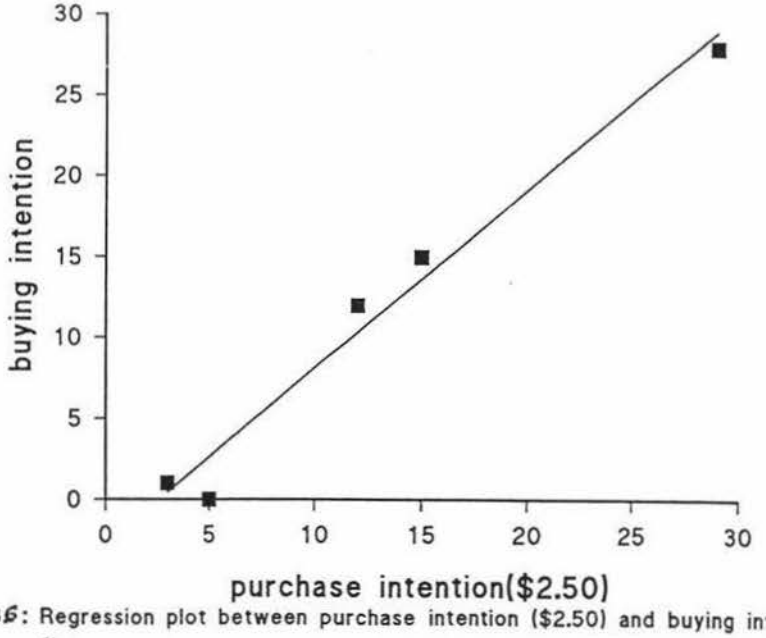


Figure 86: Regression plot between purchase intention ($2.50) and buying intention

8.8. DISCUSSION OF CONSUMER TESTING.

8.8.1. Consumer Acceptability of the Dried Snack Fruit.

From the statistical analysis, there was a good relationships between overall acceptability and, the level of liking toward the flavour ($r = 0.949$) and the colour combination ($r = 0.976$) of the dried fruit snack. The high percentage (69%) of acceptance of the dried fruit snack among the respondents was due to the level of liking toward the flavour and colour combination of the product sample. From this study, it shows that the idea of using the variety of the dried fruit with natural flavour as a snack food was acceptable by the Malaysian students who study at Massey University.

Of the two attributes, a strong relationship was found between the colour combination level of liking and the overall acceptability (R^2value = 95.2%). This shows that the colour combination of product sample was the most important attribute for the respondents in indicate their level of acceptability of the dried fruit snack sample.

However, the slight decrease of the overall acceptability percentage (69%) among the respondents when compared to the percentage of level of liking toward the flavour (71%) and colour combination (83%) was because some of the respondents stated that they did not like the taste and odour of the Kiwifruit. They stated that the Kiwifruit had too sour a taste and strong odour. They suggested that it was better to increase the sweetness of the kiwifruit flavour for it to have a more acceptable taste.

They also commented that, they did not like the spongy texture of Strawberry, Kiwifruit and Apple, due to the tooth packaging problem. They suggested that the three fruits should have more crunchy texture.

Overall, most of the Malaysian students (69%) liked and accepted the idea of using a variety of dried fruit as a snack food product as it produce an attractive product colour combination and the variety of fruit flavour in the one package. This differentiated the product from existing products on the market.

8.8.2. **Marketing Information from Consumer Testing.**

The price of $2.50/40gm(RM4.25) appeared to be acceptable to the respondents in which 68% of the respondents were interested in buying the dried snack fruit sample at that price and, it was also found that the highest percentage (27%) of the proposed price by the respondents was $2.50.

There was a high percentage of respondents (72%) who would buy the dried fruit snack regularly (once a week, once a fortnight, and once a month), even though the price of the product sample was expensive as compared to competitors' prices.

From the statistical analysis, a positive correlation coefficient ($r = 0.979$) was found between the purchase intention and overall acceptability among the respondents toward the dried snack fruit sample. The acceptability of the product sample attributes and the exciting feeling of the respondents toward the product idea had influenced their purchase intention. It was also found that the percentage of respondents that would buy the product sample at least once or more a month was higher.

However, when the respondents were ask to indicate the maximum prices they would be prepare to pay for the product sample most of the respondents indicate that $2.50/40gm was the maximum price. At this stage, most of the respondents think that the price of more than $2.50/40gm was an expensive price for the snack food product due to two reasons. Firstly, most of the fruit in the product sample was available in New Zealand and it is available at the cheap price. Most of the respondents, however, were not aware that this product sample was developed solely for Malaysian market where most of the fruit in the dried snack fruit product is expensive in Malaysia.

Secondly, when the price of $2.50/40gm was converted to RM(Malaysian money) it could be RM4.25/40gm or RM4.50/40gm in which $1.00 is equal to RM1.70 or RM1.80. The fluctuation of money exchange rate and money exchange rate value may influenced the respondents in the choice of maximum price for the product. When the suggested price was convert to Malaysian money the price was quite high.

8.8.3. **The Pattern of Dried Snack Fruit Usage of the Consumer.**

From this study, it was found that even though the idea of using the dried fruit snack as the breakfast cereal and as a dessert was new to the Malaysian students, 19% of the respondents would eat the dried snack fruit as their breakfast cereal and 14% of the respondents would used it in the dessert. This showed that the usage of the dried snack fruit product as a breakfast cereal or a dessert was found acceptable by the Malaysian students. This may be because the Malaysian students had adapted to the 'Kiwi' lifestyle especially since the dried fruit are found in New Zealand.

On the contrary, the idea of using the snack food product in cooking was very unfamiliar to the Malaysian students. Because of that none of the respondents would think to use the dried snack fruit in the cooking.

8.8.4. **Consumer Buying Intention.**

From the statistical analysis, it was found that purchase intention at the price of $2.50/40gm (R2 value = 97.5%) has a strong influenced on buying intention decision amongst the Malaysian students than the sensory acceptability (R^2 value = 91.6%). This showed that, for Malaysian students, price was an important factor for them in determining their buying intention toward the dried snack fruit not the sensory attributes. The changes in price would effect the purchase intention among the respondents, at the same time, it would also effect the buying decision of the product sample.

However, it is difficult to forecast the market potential of the dried fruit snack for Malaysian market from the consumer testing because of the small sample size of the respondents (64 respondents) and this may not representative of the target population for the dried fruit snack product. This was due to the limited number of Malaysian students studying at Massey University. If the consumer testing is carry out in Malaysia, more than one hundred respondents would be necesarry to gage the market potential of the dried fruit snack product in order to forecast success.

8.9. **CONCLUSION.**

From the final consumer testing, it shows that the idea of developing dried snack fruit that consists of tropical fruit and New Zealand's fruit for a new snack food product was acceptable among the Malaysian students. The natural flavour and

the colour combination of the product sample were also found acceptable by the Malaysian students.

The suggested price of $2.50/40gm for the dried snack fruit sample was acceptable to the respondents due to the higher percentage of purchase intention at the price of $2.50/40gm.

The idea of using dried fruit snack in cooking was not acceptable to the respondent as none of them indicate that they would use the product sample in the cooking. However, it is surprising to know that the idea of using a snack food product as a breakfast cereal and as a desert was accepted by the respondent, even though the usage was new to the respondents.

From this consumer testing, it was very difficult to forecast the market potential of dried fruit snack product for the Malaysian market due to the small sample size used in this study because only Malaysian students studying at Massey were used in this consumer testing. The results of this study would be more significance if a bigger sample size had been used and the consumer testing was conducted in Malaysia.

From this study, it was found that the purchasing decision at a particular price played a major role in indicating the buying intention of dried fruit snack among the Malaysian students.

CHAPTER 9

CONCLUSION AND RECOMMENDATION

9.1. CONSUMER RESEARCH IN THIS PROJECT.

There were two techniques of consumer research used in this project: the focus group technique and the survey method. The purpose of this study was to determine the consumers' attitudes toward the dried snack fruit product and the attributes of the product.

It was important to understand the market before a survey could be conducted to prevent collecting irrelevant data for the study (Wan, 1987). Hence, the focus group technique was used as exploratory research which provided information about consumer attitudes and behaviour towards the existing products and the attributes of a proposed product.

Based on the results of the focus group, a questionnaire for the survey method was designed and the description of the proposed dried snack fruit was obtained. The results from the consumer research also showed that the idea of developing a snack food product based on dried fruit or vegetables was acceptable among the Malaysian students.

The most important information obtained from this consumer research was that Malay students and Chinese students who have been studying in New Zealand can be treated as one community for any further study in this project as they had similar attitude and behaviour characteristics towards the dried snack fruit product. This may due to the change in their eating habits since they have been studying in New Zealand for the last two years at least.

9.2. NOMINAL GROUP TECHNIQUE IN IDEA GENERATION

For this study, new product ideas were generated using the Nominal Group Technique (NGT) as it was well structured, quick, and easy to use for the untrained participants (Wan 1987). As the participants in the NGT session were the same participants as those used in the focus group for the exploratory study in consumer research, comparison could be made between the two techniques.

The participants preferred the NGT to the focus group due to the tight structure of NGT which minimised the disruption and arguments between the participants and also the nature of the NGT gave an equal opportunity for each panelist to participate and this reduced the influence of dominant members in the group.

However, the NGT produced mostly modified product ideas from the existing products rather than completely new product ideas. This may be due to two factors. Firstly, the silent idea generation where participants were asked to individually reflect to the aim of this project. Secondly, it was found that some participants thought that the task of idea generation was over once they had written down a list of ideas on a worksheet at the early stage of the NGT session. Hence, they did not attempt to think of any new ideas beyond that point, even though, they were encouraged to do so.

The more innovative and novel ideas probably would have been produced if the participants had been trained for this purpose or if more than one NGT session had been conducted for this project.

9.3. PRODUCT CONCEPT TESTING IN THIS PROJECT.

Product concept testing was the main focus of this project as, by this stage, the potential new product ideas had been identified during the screening and, were presented to the target consumers to be evaluated on consumer acceptability.

There were two different forms of communication: the product concept description and product concept prototype. Both were tested to determine any significant effects product concept presentation had on the panellists' preference of product concepts attributes, buying intention, and price preference among the Malaysian students. Simultaneously, two different forms of product concept evaluation: the focus group and the survey method, were also tested for the same purposes.

From this study, it was found that the concept prototypes had a significant effect on the panellists' preference for product appearance and attractiveness, and buying intention. The panellists had some difficulty visualising the appearance and the attractiveness of the product just from reading the product concept description. The lack of the researcher's ability to present the product concept description clearly and interestingly to the group, may have contributed to the misinterpretation of the product concept from the real prototype.

Of the three the product attributes, appearance, attractiveness, flavour, which had been tested for the attractiveness of the product concept had a good relationship with buying intention preference among the panelists. This showed that the attractiveness of the dried fruit combination in the product concept played a major role in the buying intention decision of the panelists.

The results showed that there was no significant difference between the focus group technique and the survey method on overall product concept preference, the product concept attributes preference, buying intention, and purchasing price preference.

Nevertheless, the focus groups could provide more information about the consumers' needs and the consumers' interactions with the product concept compared to the survey method. Furthermore, the focus groups required less time for data collection as the group of people could be gathered together at one session in one place compared to the survey method, where only one or two people could be interviewed in one session.

The focus group technique however needed more time to analyse the recorded information compared to the survey method where the data was be computed instantly. Of the two techniques, the focus group was more expensive to run than the survey method.

Both techniques can be used for testing the product concept of the dried snack fruit. The choice of which technique was most appropriate depended on two factors; firstly, time constraints, and secondly, the total budget of the project.

In this project, the results showed that it was most appropriate to use both the focus group and the survey method to test the product concept of the dried snack fruit as it was difficult to write a good concept statement which communicated the product very well to the panelists,. The focus group was used in the preliminary concept testing during the development of a good product concept statement. Once the good product concept statement was developed, the survey technique was conducted in order to get a reliable set of data for product concept acceptability by the consumer.

If only one focus group session was conducted at the early stage of concept statement development the cost of product concept testing would be greatly reduced. Once a good product concept statement was developed, the development of concept prototype was not necessary. Since the attractiveness of the product concept had significant effects on the buying decision, it was appropriate to present the concept description with a photo of the product concept.

9.4. CONSUMER PANEL IN SENSORY EVALUATION.

Of the four product concepts that were selected from the screening stage, two product concepts were chosen to be developed further and an optimum product formulation was obtained for the dried snack fruit product. Twenty Malaysian students from Massey University and Wanganui Polytechnic were chosen for the sensory evaluation a part of this project. In the sensory evaluation, the line scale method with floating ideals was used. By using the ECHIP programme and the results from the sensory evaluation, an optimum product formulation for dried snack fruit was obtained.

The sensory evaluation showed that, the panelists had no difficulty in using the line scale to identify differences between the samples, and to pinpoint their ideal score for each sensory attribute. The only limitation of using the floating ideal in the line scale in this project was obtaining "outsider" scores from two students of Wanganui Polytechnic for appearance acceptability and overall acceptability. The "outsider" score was obtained due to the large ratio scores of the these two panelists. This problem was overcome by eliminating the ratio scores of the two students for both attributes.

From the sensory evaluation results, the sensory attributes of the prototypes such as colour, taste, texture, and fruit mixture were found to be acceptable among the panelists. Of all the sensory attributes, the colour combination of the dried snack fruit prototypes was found to be the most affective attribute. The overall colour of the prototype was significantly effected by the amount of strawberry in the samples. This showed that the increased redness of the sample increased the acceptability of the product sample.

By using the ECHIP programme and inputting the ratio scores from the sensory evaluation, an optimum formulation of dried snack fruit was obtained quickly and easily. The simple and systematic ECHIP programme along with the input of the consumer panels made the programme the best technique for designing the product formulation.

9.5. CONSUMER FINAL PRODUCT TESTING.

To determine the acceptability potential of the prototype among the Malaysians final product testing was carried out using Malaysian students at Massey University as the prime consumer. Due to the limited number of Malaysian students at Massey University only 64 Malaysian students were available for the final product testing session.

The results from the product testing session showed that the idea of developing the dried snack fruit with their natural flavours was most acceptable by the Malaysian students. This was probably due to the familiarity of the fruits and their natural flavour.

The usage of the dried snack fruit product as a breakfast cereal or a dessert was found acceptable by the Malaysian students, even though, these applications were unfamiliar to the Malaysian students. It would seem, from this result, even though

the Malaysian students used for this test have been studying at Massey University for less than two years, the idea of using dried fruit with breakfast cereal or as a dessert is an adaptation of the 'Kiwi' lifestyle especially since dried fruit are found in such products in New Zealand. The idea of using the dried snack fruit in cooking however, was not acceptable by the panelists as this use was very unfamiliar to them.

From the consumer product testing, it was shown that the familiarisation and frequency of exposure to the product were the main factors that affected product acceptability of the consumer. Furthermore, the adaptation to the environment had changed the food habits of the Malaysian students. If the product concept testing was carried out in Malaysia, the results of the testing would have been different as the fruit like kiwifruit and strawberry are rare in Malaysia, and unfamiliar to the consumer in Malaysia. Moreover, eating breakfast cereals with the dried fruit and using the dried fruit in a dessert was unusual to Malaysians but not the Malaysian students who have lived in New Zealand for less than two years.

From the consumer product testing, it was difficult to forecast the market potential of the dried snack fruit product on the Malaysian market due to the small sample size of panelists (64) in this study. The results obtained from this study only showed that the idea of developing a dried snack fruit product based on a combination of New Zealand fruit and tropical fruit in their natural flavour was pleasing and acceptable to the Malaysian students in New Zealand.

In order to get reliable data for the market potential of the dried snack product in this study, it is essential that a study of product testing be conducted in Malaysia because the Malaysian panels in New Zealand have already adapted their eating habits to the 'Kiwi' lifestyle and a bigger sample size should be used which represents the target population of Malaysian. However, for this project, product testing cannot be conducted in Malaysia due to the time and budgetary constraints.

9.6 DEVELOPMENT OF DRIED SNACK FRUIT FOR MALAYSIANS.

From the focus group session in consumer research, the preferred characteristics of the proposed dried snack fruit were also determined. The results showed that the idea of using a mixture of dried fruits and vegetables for the dried snack fruit was not acceptable. The panelists preferred the separated ingredient combination due to the slice shape of dried fruit which did not mix well with the smaller shapes of dried vegetables.

The idea of using spicy flavours for the dried fruit was found to be unacceptable among the panelists. The ideal flavour for the dried fruit according to the panelists was to be its own natural flavour and spicy or salty flavour was found to ideal for the dried vegetables.

For the preferred drying process of the fruits and vegetables, the freeze dried product was preferred compared to the air dried product. This was due to the crunchy texture of the fruits and vegetables obtained when they were freeze-dried. Moreover, the freeze-dried fruits and vegetables retained their natural colour and shape increased the acceptability of freeze dried product among the panelists.

Based on the consumer research results, the outline of the proposed product was obtained. This description was used as a guideline in the idea generation stage. From forty-one product ideas obtained in the idea generation stage, three product ideas were identified during the screening stage to have market potential. These

were: mixed fruit, mixed vegetable, and mixed fruit and vegetable. Then the product ideas with a benchmark (tropical freeze dried fruit) were tested using the target consumer in product concept testing to evaluate consumer acceptability.

Of the four product concepts: the dried vegetable snack (pumpkin, carrot, peanut), the dried 'Kiwi' fruit snack (apple, kiwifruit, strawberry), the dried fruit and vegetable snack (apple, carrot, kiwifruit, peanut), and the dried tropical fruit snack (banana, jackfruit, pineapple). Two product concepts; the dried 'Kiwi' fruit snack and the dried tropical fruit snack, were chosen for product formulation stage as both product concepts were the most preferred product concepts among the panelists.

By using the ECHIP programme and the results from the sensory evaluation, an optimum product formulation for the dried snack fruit was obtained. The prototype consisted of six types of fruit such as apple, kiwifruit, banana, pineapple, strawberry, and jackfruit with the ratio, as shown below;

Apple	0.25
Kiwifruit	0.25
Banana	0.175
Pineapple	0.13
Strawberry	0.125
Jackfruit	0.07
Total	1.00

From the product formulation stage, a prototype of the dried snack fruit product for the Malaysian market was produced and was tested on the target consumer to determine the acceptability potential of the prototype. The results from the product testing session showed that the idea of using the combination dried fruit from New Zealand's fruit and tropical fruit with their natural colour was acceptable among the consumers.

9.7. RECOMMENDATIONS FOR THE FURTHER WORK.

At the initial stages of this study, focus group was used to determine the attitudes and behaviour of consumers toward the existing product, and the preferred attributes of dried snack fruit. Based on the information obtained from the focus group, the guidelines for the idea generation stage were intended. In this study, only one session of the focus group was conducted, as the focus group was one of the important stages in the product development process of this project. Further work should be done with more than one focus group so more reliable information will be obtained from the consumer.

In this study, the freeze dried method was used to produce the dried snack fruit product. The freeze drier was chosen for this method because it was the most preferred drying method according to the panelists in the focus group. However, by using this method, the processing cost of the product increased. It is recommended that the combination of a freeze-drying process and other drying processes such as vacuum drying or microwave drying be used. These drying process should maintain the quality of the product at the end of the day.

From this study, it was found that the idea of developing the dried snack fruit product was acceptable by the Malaysian students in New Zealand. For the further work, testing the prototype in Malaysia to determine the acceptability potential of the prototype among the Malaysia people is recommended.

REFERENCES

Amerine, A.A., Pangborn, R., Roessler, E.B. 1965. Principles of Sensory Evaluation of Food. New York:Academic Press.

Anon. 1982. Dehydration and Compression of Foods. In: Commercial Fruit Processing (2nd. ed). Woodroof, J.G., and Luh, B.S. 1986 (eds). Westport:AVI Publishing Company Inc.:381-382

Anonymous. 1992. Snack in Southest Asia. Asia Pacific Food Industry Business Report, June, 4(6):5

Armstrong, J. and Overton, J. 1971. Brief vs Comprehension Descriptions in Measuring Intentions to Purchase, J. of Marketing Research, 8:144-117.

Arsdel, V.W.B.,1973. Food Dehydration. Westport: AVI Publishing Company Inc.

AOAC, (1990), Official Methods of Analysis, (16th. ed.), The Association of Official Analytical Chemists.

Babcock, D. 1990. Choice Products the Dry Way, Food Packaging Technol. International: 175-177.

Baker, K.G., and Alboun, G.S. 1986. Modelling New Product Screening Desicion, J. Product Innovation Management, 1:32-39

Baten, W.B. 1964. Organoleptic Test Pertaining to Apples and Pears, Food Res., 11:84-94

Bloom, H.E. 1977. Match the Concept and the Product, J. of Advertising Research, October, 17(5):25-27

Booth, D.A. 1985. Sensory Influences on Food Acceptance the Neglected Approach to Nutrition Promotion, British Nutrition Foundation Bulletin. 13:39-54

Booth, D.A. 1990. Health Responsible Food Marketing. British Food Journal. 91(6):7-14

Booz, Allen Hamilton. 1982. New Product Management for the 1980's. N.Y.: Booz Allen Hamilton

Cafarelli, E.J. 1980. Developing New Products and Repositioning Mature Brands. A Ronald Press Publication.

Calder, J. 1977. Focus Group and the Nature of Qualitative Marketing Research, J.of Marketing Research, 14:353-364

Campsey, Birgham, Gilroy and Hutchinson. 1994. Introduction to Financial Management, Australia:Harcart Bruce and Company

Challiss, P.,B. 1991. Product Development of Equipment for People with Disabilities the Development. Master of Technology in Product Development Thesis, Massey University, Palmerston North, New Zealand

Chapman, A. 1988. Concept Testing: A Discussion, British Food J. 90(4):166-171

Claxton, J.D., Richie, J.R.B., Zaichkowsky, J. 1980. The Nominal Group Technique: Its Potential for Consumer Research, J. of Consumer Research, December, 17:308-313

Colby, S. 1973. When, Why and How of Concept Testing, Food Product Development, May:57-71

Cooper, R. 1981. The Myth of the Better Mousetrap: What Makes A New Product Success?. Bussiness Quaretely, 68:81

Crawford, C.M. 1994. New Products Management (4th ed). Richard D Irwin.

Earle, M.D. 1973. The Science of Product Developments and its Application to the Food Industry, New Zealand:Massey University Publication

Earle, M.D., and Anderson, A.M. 1985. Product and Process Development in Food Industry. Amsterdem:Harwood Academic Publisher, OPA Ltd.

Earle, M.D. 1995. Consumer Marketing of Food Products, Consumers Markets and Marketing, Department of Food Technology, Massey University

Ed Neff. 1985. Product Development in the Large Food Company. In: Product and Process Development in Food Industry, Earle, M.D., and Anderson, A.M.. Amsterdem:Harwood Academic Publisher, OPA Ltd.

Euromonitor Report. 1991. Food Markets In South East Asia.

Fraser, S.A. 1994. Concept Testing: A key to Successful Product Development, Discussion Paper No.1, July, Department of Economics and Marketing, Lincoln University, Canterburry

Fulmer, W. and Fulmer, R. 1990. Strategic Group Technique: Involving Managers in Strategic Planning, Long Range Planning, 23(2);79-84

Flink, J., and Karel, M. 1970. Effects of Process Variables on Retention of Volatiles in Freeze Drying, J. Food Sc. 35:444-447

Fortune, J. 1992. Idea Generation Technique for Quality Improvement. International J. of Quality and Reliability Management. 9(6):32-38

Graf, E., and Saguy, I.S. 1991. Food Product Development:From Concept to Marketplace. New York: Van Nostrand Reinhold

Geoff, A., and Ford, L., 1992. Nominal Group Technique and the Formulation of Competentcy Standards, Asia Pacific J. of Human Resources:61-73

Ginnette, L.F., and Kaufamn, V.F., 1968. Freeze Drying of Food. In: The Freezing Presentation of Foods (Vol. 4), Tressler, D.K., Arsdel, W.B.V., and Copley, M.J. (Eds), Westport:AVI Publishing Company Inc

Giovanni, M.E. and Pangborn, R.M. 1983. Measurement of Taste Intensity and Degres of Liking of Beverages by Graphic Scales and Magnitude Estimation. J. Food Sc. 48:1175-1182

Glodman, A.E., and MacDonald, S.S. 1987. The Group Depth Interview (Principles and Practice). Prentice-Hall, Inc.

Goulding, I. 1983. New Product Development, A Literature Review. European J. of Marketing. 17(3):3-30

Gruenwald, G. 1988. New Product Development. Lincolwood, Illinois, U.S.A.: NTC Business Books

Guilford, J.P. 1954. Psychometric Methods (2nd. ed.). N.Y:McGraw-Hill

Haley, R.I., and Gatty R. 1971. The Trouble with Concept Testing . J. of Advertising Research. 8(2):23-25

Hanson, L. 1976. Commercial Processing of Fruits, Food Technology Review, No. 30, N.J., U.S.A.: Noyes Data Corporation

Harries, J.M. 1953. Sensory Test and Consumer Acceptance. J.Sc. Food Agr., 10:477-482

Hisrich, R.D., and Peters, M.P. (1991). Marketing Desicions for New and Mature Products (2nd. ed.). N.Y.:Macmillan

Holbert, N.B., and Speece, M.W. 1993. Practical Marketing Research: An Intregated Global Prespective. N.Y: Prentice Hall

Iuso, B. 1975. Concept Testing: An Appropriate Approach. J.of Marketing Research, May, 12:228-231

King, C.J. 1968. Rates of Moisture Sorption and Desorption in Porous, Dried Foodstuffs. Food Technol, 22:509-515

King, C.J. 1971. Freeze Drying of Foods. U.S.A.:CRC Press Inc.

King, C.J. 1973. Freeze Drying. In: Food Dehydration, Volume 1 (2nd. ed.). Arsdel, W.B., Copley, M.J., Morgan, A.I. (eds).WEstport:AVI Publishing Comp. Inc.

Kotler, P. 1984. Marketing Management, Analysis, Planning and Control (5th. Ed.). N.J: Prentice-Hall International Inc.

Kotler, P., and Amstrong, G. 1991. Principles of Marketing (5th. ed.). N.J: Prentice-Hall International Inc.

Kraft, L. 1981. Focus Group: Letting Consumer Think About Your New Product Ideas. Food Technol. Nov.

Land, D.G., and Shepherd, R. 1988. Scaling and Ranking Methods. In: Analysis of Foods (2nd. ed.). Piggott, J.R. (eds). London:Elselvier Applied Sc.

MacKenzie, A.P., and Luyet, B.J. 1967. Freeze Drying and Protein Denaturation In Muscle Tissue. Nature, 215(5096);83-85

Malaysian Trade News. 1991. Malaysian Food Industry. January-March

Mathot, G.B.M. 1982. How to Get New Products to Market Quicker. Long Range Palnning, 15(6):20-30

McBride, R.C. 1982. Range Bias in Sensory. J.Food Technol, 17:405-410

Meyer, R.S. 1984. Eleven Stages of Successful New Product Development. Food Technol, 38(7):71

Moskowitz, H.R. 1975. Applications of Sensory Measurement to Food Evaluations II, Methods of Ratio Scaling. In: Analysis of Foods (2nd. ed.). Piggott, J.R. 1988(eds). London:Elselvier Applied Sc.:155-185

Moskowitz, H.R. 1977. Magnitude and Hedonic Scale of Food Acceptability. J. Food Science. 36:677-680

Moskowitz, H.R. 1983. Product Testing and Sensory Evaluation of Foods (Marketing and R&D Approaches). Westport, U.S.A.: Food & Nutrition Press, Inc.

Moskowitz, H.R. 1993. Consumer-Designed Concepts for Cereals. Cereals Foods World. November-December, 38(11): 811-816

Muller, H.G. 1977. Sensory Quality Control: Report on A Survey. In: Sensory Quality Control: Practical Approaches in Food and Drink Production. Symons, H.W., and Wren, J.J. (eds). London:Soc. Chemical Industry

Page, A.L., and Roseboun, H.F., 1992. Developing an Effective Concept Testing Program for Consumer Durables. J. Product Innovation Management, 9:267-277

Pangborn, V.R.M., 1965. Consumer Studies. In: Principles of Sensory Evaluation of Food. Amerine, M.A., Pangborn, V.R.M., and Rossler, E.B. Academic Press Inc.

Pangborn, V.R.M. 1984. Sensory Techniques of Food Analysis. In: Foods Analysis: Principles and Techniques Vol 1. Gruenwedel, W.D. and Whitaker, R.J.New York.: Marcel Dekker Inc.

Pearson, G. 1986. The Strategic Discount-Protecting New Business Projects Against DCF. Long Range Planning, 19(10):18-24

Rey, L. 1960. Thermal Analysis of Eutectics in Freezing Solutions. Ann. New York Academic Science, 85:510-534

Roche, M., Lodge, G., and Yasin, J. 1970. A Pre-Test Market Programme. Admap, April

Rochford, L. 1991. Generating and Screening New Product Ideas. Industrial Marketing Management, 20:287-296

Salunkhe, D.K., and Bolin, H.R., and Reeby, N.Y. 1991. Storage Processing and Nutrition Qualitiy of Fruits and Vegetables Vol. 2 (2nd. ed). U.S.A.:CRC Press Inc.

Saravanos, G.D., and Moyer, J.C. 1968. Volatility of Some Flavour Compounds During Freeze Drying of Foods. Chemical Engineering Programme Symposium In Series, 86(64):37-42

Schaal, A.A. 1952. Consumer Trends in New Products for Homemakers. Food Technol, 6:13-15

Shand, P.J., Hawryish, Z.H., Hardin, R.T., and Jeremiah, L.E. 1985.Descriptive Sensory Assessment of Beef Steaks by Category Scaling, Line Scaling and Magnitude Estimation. J. Food Sc., 50:495-500

Shepherd, R., and Griffins, N.M., 1987. Preferences for Eggs Product Under Different Systems Assessed By Consumer and Lab Panels. In: Analysis of Foods (2nd. ed.). Piggott, J.R. 1988(eds). London:Elselvier Applied Sc.

Sherak, B. 1966. Testing New Product Ideas, ESOMAR Congress Paper, Paper No. 12

Sian, N.K. and Ishak, S. 1991. Caratenoid and Anthocyanin Contents of Papaya: Influence of Blanching and Predrying Treatments. Food Chemistry. 39: 175-185

Somogyi, L.P., and Luh, B.S. 1968. Freeze Drying of Fruit. In: Commercial Fruit Processing (2nd. ed.). Woodruf, J.G., and Luh, B.S. (eds). Westport:AVI Publishing Company Inc.

Song, P.S., and Chichester, C.D., and Stadtman, F.H. 1966. Kinetic Behaviour and Mechanish of Inhibition in the Milliard Reaction. I Kinetic Behaviour of the Reaction Between D-Glucose and Glycine. J.Food Sci., 31:906-913

Spiess, W.E. 1964. Kaltetechnik, 16:349. In:Freeze Drying of Foods. King,C.J. 1971 (eds) U.S.A:CRC Press Inc.

Stevens, S.S. 1953. On the Brightness of Lights and the Loudness of Sound. Science:188-576

Stone, H., Sidek, J., Oliver, S., Woosley, A., and Singleton, R.C. 1974. Sensory Evaluation by Quantitative Description Analysis. Food Technol. 29(11):24-34

Tauber, E.M. 1972. What is Measured by Concept?. J. of Advertising Reserach, December,12(6):35-37

Thijssen, H.A.C., and Dulkens, W.H. 1969. Effects of Freezing Rate On Rate of Sublimation in Freeze Drying. Symposium on Thermodynamic Aspects of Freeze Drying:International Institute of Refrigeration Commission, Switzerland

Twiss, B. 1986. Managing Technological Innovation (3rd. ed). London:Pitman Publishing

Uaphithak, H. 1994. Consumer Research and Product Optimization for Glue Stick Development in Thailand. Doctor Philosophy in Product Development Thesis, Massey University, Palmerston North, New Zealand

Vollink, W.C., Kenyon, R.E., Barnett, S., and Bowden, H. 1968. Freeze Dried strawberries for Incorporation in Breakfast Cereal. In: Commercial Processing of Fruit. Hanson. 1976. (eds). Food Tech. Review No. 3, N.J., U.S.A.:Noyes Data Corporation

Wan, L.P. 1987. Development of a Bakery Snack for Export from New Zealand to Malaysia. Doctor Philosophy in Product Development Thesis, Massey University, Palmerston North, New Zealand

White, R. 1973. Consumer Product Development. London:Longman

Wind, Y.L. 1982. Product Policy: Concepts, Methods and Strategy. Reading, Addison-Westley Publishing Company.

Wiriyacharee, P. 1990. The Systematic Review of a Controlled Fermentation Process Using Mixed Bacterial Starter Culture for Nham, a Thai Semi-Dry Sausage. Doctor Philosophy Thesis in Food Technology, Massey University, Palmerston North, New Zealand

Zikmund, W.G. 1982. Exploring Marketing Research. N.Y.: The Dryden Press

Zuech, N. 1992. Identifying and Ranking Opportunity for Machine Vision in A Facility. Industrial Engineering, October:42-44

APPENDIX 1.1: Market Information of Snack Food Product Available in the Three Supermarket in Kuala Lumpur.

No	Product Name	Manufacture	$/100gm	RM/100gm	RM/wt
Dried Fruit Chips					
1	Dried mangoes	Kian Hin Traders	1.06	1.8	1.25/0.70
2	Dried papaya stripes	"	1.18	2	1.00/0.50
3	Pre-dried limes	"	1.68	2.86	2.00/0.70
4	Dried jackfruit	"	2.15	3.65	2.20/0.60
5	Sour plum	"	2.35	4	4.00/100
6	Sweet dried plum	"	1.52	2.58	3.35/130
7	Preserved strawberry	"	0.76	1.3	1.30/100
8	Pre dried lemon	"	0.92	1.55	1.40/0.90
9	Red sour plum	"	1.12	1.9	1.90/100
10	Dried guava	"	1.47	2.5	2.00/0.80
11	Dried mangoes	Cebu Legacy Marketing Corp.	1.82	3.1	3.10/100
12	Banana chips	Ley Kau Poh Sdn. Bhd.	0.98	1.67	2.00/120
13	Tapioca chips	Haliq Mills Sundries	1.41	2.4	1.20/150
14	Tapioca chips	Syarikat Emas Food Industry Sdn. Bhd.	0.95	1.62	1.30/0.80
15	Tapioca crackers	Fresh Interprise	2.2	3.75	1.50/0.40
16	Tapioca crackers	On and On Food Prod.	1.47	2.5	0.30/0.12
17	Sweet potato chips	Campro (M) Sdn. Bhd.	1.05	1.8	1.80/100

NZ$1.00=RM1.69

Continued **Appendix 1.1**

No	Product Name	Manufacture	$/100gm	RM/100gm	RM/wt
18	Corn chips	Pacific World Sdn Bhd.	0.7	1.2	1.20/100
19	Dehydrated jackfruit	Narsco Fruit Chips Industries Sdn Bhd	2.94	5	1.25/0.25
20	Dehydrated starfruit	"	2.94	5	1.25/0.25
21	Dehydrated pineapple	"	2.94	5	1.25/0.25
25	Freeze dried banana		5.43	9.23	6.00/0.65
26	Freeze dried pineapple		5.43	9.23	6.00/0.65
27	Melon stripes	Quay Line Fare Price Sdn. Bhd.	0.29	0.5	1.00/200
Dried Seafood Chips					
29	Pre-pared Cuttle Fish	Compro (M) Sdn. Bhd.	3.92	6.67	2.00/0 30
30	Fish satay	Desa Southern Agency Sdn. Bhd.	1.62	2.75	2.20/0.80
31	Dried fish chips	Compro (M) Sdn. Bhd.	2.94	5	2.00/0.40
32	Cuttle fish chips	Popular Trading	2.67	4.54	5.90/130
33	Cuttle fish lemon chips	Ken Key Ground Nut Factory	3.14	5.33	3.20/0.60
Snack based on Nut					
34	Fried peanut	Home Peanut Garden Food Ind. Sdn Bhd.	1.41	2.4	1.20/0.50
35	Peanut	Syarikat Haja Haliq Sdn. Bhd.	0.55	0.95	0.95/100

NZ$1.00=RM1.69

Continued **Appendix 1.1**

No	Product Name	Manufacture	$/100gm	RM/100gm	RM/wt
36	Chewsnut	Syarikat Hajar Kaliq Sdn Bhd	1.96	3.33	5.00/150
37	Roasted Horse Grani (Skinless)	Quay Line Fare Price Sdn Bhd	0.7	1.2	2.40/200
39	Sunflower seed	"	0.57	0.97	1.45/150
40	White pumpkin seed	"	0.73	1.25	1.25/100
41	Rani green peas	"	0.63	1.07	1.60/150
Extruder Snack					
47	Prawn Crackers	Desa Southern Food Product Sdn Bhd.	1.24	2.1	1.05/0.50
48	Double deckers	Mamee Pacific Food Product Sdn. Bhd.	1.47	2.5	1.25/0.50
49	Ziggie	Smart Food Corp. Sdn. Bhd.	1.18	2	1.40/0.70
50	Vegetables crackers	Quay Line Fare Price Sdn. Bhd.	0.39	0.67	1.00/150
51	Appallam slice	"	0.47	0.8	1.20/150
52	Spin crackers	Sun Food Product Company	1.47	2.5	1.00/0.40
53	Fish crackers	On and On Food Product	1.18	2	0.30/0.15

NZ$1.00=RM1.69

Continued **Appendix 1.1**

No	Product Name	Manufacture	$/100gm	RM/100gm	RM/wt
55	Cottage Fries Wise	Borden Foods (M) Sdn Bhd	1.87	3.18	0.70/0.22
56	Cheezel	Kebler Company (M) Sdn Bhd	1	1.71	0.60/0.35
57	Rice crunch	Compro (M) Sdn Bhd	1.32	2.25	1.80/0.80
58	Sajima	"	0.86	1.47	2.20/150
59	Plait Crunch	"	0.7	1.2	1.80/150
60	Crunchy Vegetable Crackers	KMM Sdn Bhd.	1	1.7	1.70/100
61	Crunchy R Crackers	"	0.88	1.5	1.50/100
62	Prawn Crackeres	"	0.76	1.3	1.30/100

NZ$1.00=RM1.69

Appendix 3.1: Description of existing snack food product.

Product Name	Product Description	Packaging
1. Cheesezel	Type: Extruder snack Flavour: Cheesse Shape: Cyclinder with hole in the middle	Laminated aluminium palstic bag
2. Cheeseball	Type: Extruder snack Flavour: Cheesse Shape: Round	Laminated aluminium plastic bag
3. Pretzel	Type: Baked snack Flavour: Plain, salted Shape: Rod	Laminated plastic bag
4. Pretzel	Type: Baked snack Flavour: Seed Shape: Varieties	Laminated plastic bag
5. Bhuja mix	Type: Fried snack Flavour: Spicy Shape: Rod Mix with: peanut, peas	Plastic bag
6. Planters corn chips	Type: Corn chips Flavour: Plain Shape: Triangle	Can
7. Planters nut	Type: Nuts Flavour: Nuts and salty Ingredient: peanut, peas, raisin	Can
8. Manchos	Type: Extruder snack Flavour: Tomato spices Shape: Cyclinder	Plastic bag
9. Grain waves	Type: Chips Flavour: Vinegar Shape: Triangle	Laminated plastic bag

Appendix 3.2: The Questionnaire of Consumer Survey.

I am a postgraduate student at Massey University. As a part of my course, I am required to do consumer survey among the Malaysia student at Massey University to determine their attitude and characteristic toward a new snack food product.

I would greatly appreciate if you would fill in this questionnaire. Thank you very much for your assistance with this consumer survey.

Questionnaire.

Please tick in the box for the appropriate choice.

1. Do you eat snack food?

☐Yes
☐No

2. How often do you eat snack food?

☐Daily
☐Every two or three days
☐Weekly
☐Every now and then
☐Never

3. What type of snack food do you eat?

☐Potato chips
☐Pickled snacks
☐Snacks based on popcorn
☐Puffed snacks
☐Baked snacks
☐Nut based snacks
☐Other (Please specify)_____

4. Have you ever eat dried snack fruit?

☐Yes
☐No - If the no, please escape all the question below accepts question 14.

5. How often do you eat dried snack fruit?

☐Daily
☐Every two or three days
☐Weekly
☐Every now and then
☐Other (Please specify)_____

Continued **Appendix 3.2**

6. What type of dried fruit do you usually eat?

- ☐Dried prune
- ☐Dried apricot
- ☐Dried fig
- ☐Dried banana chips
- ☐Dried dates
- ☐Muscatels
- ☐Raisin
- ☐Sultanas
- ☐Other (Please specify)_____

7. What type of brand dried snack fruit do you usually eat?

- ☐Sun Valley
- ☐Sunsweet
- ☐Sundora
- ☐Sun World
- ☐Saratoga
- ☐Sunmaid
- ☐Excello
- ☐Foodtown
- ☐Other (Please specify)_____

8. Why do you like to eat dried snack fruit?

- ☐Nutritious/Healthy food
- ☐Convenience
- ☐You like the taste
- ☐Other (Please specify)_____

Description of New Product.

The product is a new nutritious snack food, Nutri Bite, consists of mixture of dried fruit such as Kiwifruit, Peach, Feijoas, and Apple with spices' flavour. The product can be used as a snacker for leisure, party and between meal. It will pack in laminated aluminium and plastic packaging that is easy to carry everywhere.

Continued **Appendix 3.2.**

9. How likely would you be try this product?

- ☐Very likely
- ☐Quite likely
- ☐Neither likely nor unlikely
- ☐Quite unlikely
- ☐Very unlikely (Please specify)_____

10. How do you perceive this product when compared to existing snack food on the market?

- ☐Unique
- ☐Very different
- ☐Quite different
- ☐Similarly

11. Do you like the combination of the snack fruit?

- ☐Very likely
- ☐Quite likely
- ☐Neither likely nor unlikely
- ☐Quite unlikely
- ☐Very unlikely

12. What type of flavour would you prefer with the dried snack fruit product?

- ☐Natural
- ☐Spices
- ☐Sweetness
- ☐Salting
- ☐Other (Please specify)_____

13. When do you eat the snack fruit product?

- ☐Between meals
- ☐As a dessert
- ☐Parties
- ☐Watching movies/t.v.
- ☐Other (Please specify)_____

Continued **Appendix 3.2**

14. What is the maximum price you would be prepared to buy for the snack fruit of the size 100gm net?

□$3.00
□$2.50
□$2.00
□$1.80
□$1.50
□$1.20
□Other (Please specify)_____

15. Would you choose this product instead of your regular dried snack fruit if it were available at your supermarket?

□Definitely choose
□Probably choose
□Might or might not
□Probably not choose
□Definitely not choose

16. How often would you buy the product compare to your regular dried snack fruit?

□Daily
□Every two or three days
□Weekly
□Once
□Never

17. How interested would you be in buying the product if it were available at your supermarket?

□I would definitely buy
□I would probably buy
□I might or might not buy
□I would probably not buy
□I would definitely not buy (Please specify)_____

18. Age and sex of person filling in questionnaire.

Age(years)	Sex	Ethnic group
□18-20	□Male	□Malay
□21-24	□Female	□Non-Malay
□25-30		
□Over 30		

Appendix 3.3: The Statistics Analysis of Consumer Survey.

Questionnaire no.	Mean	Standard deviation	P-value.
1. Frequency of snacking.			0.88
Malay	5	3.67	
Non-Malay	5.4	4.34	
2. Snack type preference.			0.69
Malay	3.9	6.57	
Non-Malay	5	5.33	
3. Frequency of snacking-dried snack food.			0.95
Malay	2.3	2.26	
Non-Malay	2.2	4.54	
4. Snack type preference-dried snack food.			0.95
Malay	3.9	3.81	
Non-Malay	4	3.20	
5. Criteria for dried snack fruit buying choice.			0.95
Malay	2.67	3.74	
Non-Malay	2.78	3.31	
6. Acceptability dried snack fruit of product proposal.			0.93
Malay	4	3.81	
Non-Malay	4.2	3.03	
7. Opinion on combination of product proposal.			1.00
Malay	5.2	3.11	
Non-Malay	5.2	3.03	
8. Opinion on proposed product flavour.			0.73
Malay	4.33	4.68	
Non-Malay	3.5	3.45	

Continued **Appendix 3.3**

Questionnaire no.	Mean	Standard deviation	P-value.
9. Expected price of the proposed product.			0.91
Malay	2.5	2.7	
Non-Malay	2.62	2.0	
10. Buying intention of the proposed product.			0.91
Malay	3.6	6.95	
Non-Malay	3.2	3.56	
11. Expected frequency of buying the proposed product.			0.83
Malay	3.6	3.05	
Non-Malay	3.2	2.68	

Appendix 5.1: The Sequential Screening

Product Idea.	Production compability	Market acceptance	Preferable flavour	Overall
* Dried Feijoas, Kiwanos, Kiwifruit and Boysenberry (individually) with natural flavour.				
* Mixture Feijoas, Kiwanos, Kiwifruit with natural flavour.				
* Munchous Apple and Feijoas sweetly and salted flavour.	f		f	f
* Mix vegetable with natural flavour.				
* Nashi and Apple (individually) crunchy.				
* Potato, Kumara and Sweet corn chips.	f			f
* Nanchos-fruit and vegetable with dip.	f			f
* Mixture fruit and vegetable. with natural flavour.				
* Kiwifruit pulp(slices), peas and nut-salted with muruku.	f			f
* Corn and Cabbage chips.	f			f
* Apple ball.				
* Fruit chips.				
* Vegetable chips with cheese or BBQ flavour.				
* Sweet corn and Potato chips with chilli flavour.	f			f
* Pizza cracker chips cover with fruit and vegetable.	f			f
* Tomato chips.	f		f	f

Continued **Appendix 5.1.**

Product Idea.	Production compability	Market acceptance	Preferable flavour	Overall
* Fruit skins. e.g. Apple.				
* Carrot ball with spices flavour.				
* Crunchy Carrot ball.				
* Carrot, Apple, Feijoas (individually) stick.				
* Fruit fingers.				
* Mix fruit.				
* Pie filling-mixture fruit and vegetable.				
* Mix fruit for cocktail.				
* Instant noodle with Cabbage, Carrot and Peas.	f			f
* Mix fruit and vegetable with pasta.	f			f
* Dried mushroom.	f			f
* Dried fruit coated with chocolate.	f			f
* Fruit icing.				
* Fruit coated with honey.	f			f
* Nashi and Apple (cube) coated with sugar.				
* Coconut candy with Apple.	f			f
* Apple and Feijoas with filling.	f			f
* Strawberry chips with sugar coated.	f			f
* Sandwich biscuit with fruit.	f			f
* Fruit biscuit.	f			f

Continued **Appendix 5.1**.

Product Idea.	Production compability	Market acceptance	Preferable flavour	Overall
* Wafer dried fruit.	f			f
* Cone fruit.	f			f
* Apple, Nashi and Bean muesli bar.				
* Apple, Nashi and Bean fruitflakes.				
* Fruit weet bix.				

Appendix 5.2:List of Product Ideas for Market Acceptance Evaluation.

Instruction: Please choose of the most preferacle ideas according to the ranking 8(most preferable) to 1 (less preferable).

a). Dried fruit or vegetable for the Snack Food. Ranking.

* Dried Feijoas, Kiwanos, Kiwifruit and Boysenberry (individually) with natural flavour. ☐
* Mixture Feijoas, Kiwanos, Kiwifruit with natural flavour. ☐
* Munchous Apple and feijoas sweetly and salted. ☐
* Mix vegetable. ☐
* Nashi and Apple (individually) crunchy. ☐
* Potato, Kumara and Sweet corn chips. ☐
* Nanchos-fruit and vegetable with dip. ☐
* Mixture fruit and vegetable. ☐
* Kiwifruit pulp(slices), peas and nut-salted with muruku. ☐
* Corn and cabbage chips. ☐
* Apple ball. ☐
* Fruit chips. ☐
* Vegetable chips with cheese or BBQ flavour. ☐
* Sweet corn and Potato chips with chilli flavour. ☐
* Pizza cracker chips cover with fruit and vegetable. ☐
* Tomato chips. ☐
* Fruit skins. e.g. Apple. ☐
* Carrot ball with spices flavour. ☐
* Crunchy Carrot ball. ☐
* Carrot, Apple, Feijoas (individually) stick. ☐
* Fruit fingers. ☐

Continued **Appendix 5.2**

b). Dried fruit or vegetable for Cooking Purposes.	Ranking
* Mix fruit with natural flavour.	☐
* Pie filling-mixture fruit and vegetable.	☐
* Mix fruit for cocktail.	☐
* Instant noodle with Cabbage, Carrot and Peas.	☐
* Mix fruit and vegetable with pasta.	☐
* Dried mushroom.	☐
c). Dried fruit or vegetable Confectionary.	
* Dried fruit coated with chocolate.	☐
* Fruit icing.	☐
* Fruit coated with honey.	☐
* Nashi and Apple (cube) coated with sugar.	☐
* Coconut candy with Apple.	☐
* Apple and Feijoas with filling.	☐
* Strawberry chips with sugar coated.	☐
d). Dried fruit or vegetable Biscuit.	
* Sandwich biscuit with fruit.	☐
* Fruit biscuit.	☐
* Wafer dried fruit.	☐
* Cone fruit.	☐
e). Dried fruit or vegetable for Breakfast Cereal.	
* Apple, Nashi and Bean muesli bar.	☐
* Apple, Nashi and Bean fruitflakes.	☐
* Fruit weet bix.	☐

Appendix 5.3: Checklist Screening.

Product Idea	Market acceptable (10)	Production compatability (6)	Preferable flavour (4)	Overall
* Dried Feijoas, Kiwanos, Kiwifruit and Boysenberry (individually) with natural flavour.	3.7	7	8	111
* Mixture Feijoas, Kiwanos, Kiwifruit with natural flavour.	1.4	7	6	80
* Mix vegetable with natural flavour.	1.2	10	6	96
* Nashi and Apple (individually) crunchy.	2.8	5	7	86
* Mixture fruit and vegetable. with natural flavour.	2.6	10	7	114
* Apple ball.	1.8	5	6	72
* Fruit chips.	1.9	8	6	91
* Vegetable chips with cheese or BBQ flavour.	5.7	6	9	129
* Fruit skins. e.g. Apple.	2.5	6	7	89
* Carrot ball with spices flavour.	1.0	6	5	66
* Crunchy Carrot ball.	0.1	5	2	39
* Carrot, Apple, Feijoas (individually) stick.	1.9	6	6	79
* Fruit fingers.	2.7	7	7	97
* Mix fruit with natural flavour.	4.1	10	8	133
* Pie filling-mixture fruit and vegetable.	1.4	10	6	98
* Mix fruit for cocktail.	9.3	10	8	185

Continued **Appendix 5.3**

Product Idea	Market acceptable (10)	Production compatibility (6)	Preferable flavour (4)	Overall
* Fruit icing.	0.8	10	6	98
* Nashi and Apple (cube) coated with sugar.	1.9	7	6	85
*Apple, Nashi and Bean muesli bar.	1.4	4	6	62
* Apple, Nashi and Bean fruitflakes.	4.9	6	8	117
* Fruit weet bix.	2.1	5	7	79

Appendix 5.4: Probability Screening.

Product Idea	F1 (20)	F2 (18)	F3 (16)	F4 (15)	F5 (15)	F6 (14)	F7 (12)	F8 (10)	Overall (120)
* Dried Feijoas, Kiwanos, Kiwifruit and Boysenberry (individually) with natural flavour.	17	16	13	13	13	13	11	8	104
* Mix vegetable with natural flavour.	17	18	15	14	14	12	9	8	107
* Mixture fruit and vegetable with natural flavour.	17	18	15	14	14	12	10	9	109
* Fruit fingers.	16	16	13	13	12	12	10	8	100
* Mix fruit with natural flavour.	18	18	15	13	14	13	10	9	110
* Pie filling-mixture fruit and vegetable.	15	18	14	13	13	10	9	6	98
* Mix fruit for cocktail.	18	18	15	13	14	11	10	7	106
* Apple, Nashi and Bean fruitflakes.	18	15	13	12	12	11	11	8	100

F1- Consumer acceptance
F2- Equipment and facility for R&D
F3- Development and production difficulty
F4- Development cost and time
F5- Cost of raw material
F6- Product image.
F7- Newness.
F8- Size and market potential.

Appendix 6.1: Questionnaire for Qualitative Technique in Concept Testing.

SET A.

Instruction: Could you please read through all the product concepts that have been given to you.

1. Could you please list the concepts in order of your preference.
   (4=most preferable, 1=less preferable).

   4-
   3-
   2-
   1-

2. From what you know about the product from the description, I would like you to tell me for each price (show below) whether you would buy or would not buy at that price.

Price	$3.50	$4.00	$5.00	$6.50	$7.20
Would buy	a	b	c	d	e
Would not buy	n	n	n	n	n

3. Which of the phrase best describes your opinion on the appearance of the product?
   - ☐I think , I like the appearance very much
   - ☐I think, I quite like the appearance
   - ☐I think, I neither like or dislike the appearance
   - ☐I think, I dislike the appearance
   - ☐I think , I strongly dislike the appearance

4. Which of the phrase best describes your opinion on the flavour of the product?
   - ☐I feel, I like the flavour very much
   - ☐I feel, I quite like the flavour
   - ☐I feel, I neither like or dislike the flavour
   - ☐*I feel dislike the flavour
   - ☐*I feel, strongly dislike the flavour

If dislike/strongly dislike: What did you dislike about the flavour?

_____

5. Which of the phrase best describe your opinion on the attractiveness of the product?
   - ☐Extremely attractive
   - ☐Very attractive
   - ☐Neither attractive or unattractive
   - ☐Very unattractive
   - ☐Extremely unattractive

Continued **Appendix 6.1.**

6. Which of the phrase best describes how do you think about the product concept?
   - ☐Excellent
   - ☐Extremely excellent
   - ☐Very good
   - ☐Good
   - ☐Fair
   - ☐Poor

7. How likely are you to buy the product, if it is available at your supermarket compared your regular product?
   - ☐Definitely buy
   - ☐Probably buy
   - ☐Might buy or might not buy
   - ☐Probably not buy
   - ☐Definitely not buy

SET B.

Instruction: Would please look and taste at the product prototypes.

1. Could you please list the prototypes in order of your preference.
   (4=most preferable, 1=less preferable).

   4-
   3-
   2-
   1-

2. From what you know about the product from the description, I would like you to tell me for each price (show below) whether you would buy or would not buy at that price.

Price	$3.50	$4.00	$5.00	$6.50	$7.20
Would buy	a	b	c	d	e
Would not buy	n	n	n	n	n

3. Which of the phrase best describes your opinion on the appearance of the product?
   - ☐I like the appearance very much
   - ☐I quite like the appearance
   - ☐I neither like or dislike the appearance
   - ☐I dislike the appearance
   - ☐I strongly dislike the appearance

Continued **Appendix 6.1**

4. Which of the phrase best describes your opinion on the flavour of the product?
   - ☐I like the flavour very much
   - ☐I quite like the flavour
   - ☐I neither like or dislike the flavour
   - ☐*I dislike the flavour
   - ☐*I strongly dislike the flavour

If dislike/strongly dislike: What did you dislike about the flavour?

---

5. Could you please list the prototypes in order of your preference.
   (4=most preferable, 1=less preferable).

   4-
   3-
   2-
   1-

6. Which of the phrase best describe your opinion on the attractiveness of the product?
   - ☐Extremely attractive
   - ☐Very attractive
   - ☐Neither attractive or unattractive
   - ☐Very unattractive
   - ☐Extremely unattractive

7. Which of the phrase best describes how do you think about the product concept?
   - ☐Excellent
   - ☐Extremely excellent
   - ☐Very good
   - ☐Good
   - ☐Fair
   - ☐Poor

8. How likely are you to buy the product, if it is available at your supermarket compared your regular product?
   - ☐Definitely buy
   - ☐Probably buy
   - ☐Might buy or might not buy
   - ☐Probably not buy
   - ☐Definitely not buy

THANK YOU

Appendix 6.2: The Questionnaire for Survey Method in Concept Testing.

Instruction: Could you please read through all the product concept that have been given to you and answer the questions only in the set A.

SET A.

1. What do you think about the products that have been describe in the concepts?

_____

_____

2. Does it seem to you to be different from other products you have seen in the shops, or not?

_____

_____

2a. If different: (In what why)

_____

2b. If not different:(Which is it like among products you have seen)

_____

3. Could you list the concepts in order of your preference.
(4=most preferable, 1= less preferable)

4-
3-
2-
1-

4. Which of this phrase below best describe how you feel about trying the product?
I certain would like to try this product.
I might like to try this product
*I am not sure whether I would like to try this product
I certain would not like to try this product

*Why do you say that?

_____

5. About how would you expect the product to cost in 100gm pack?

_____

Continued **Appendix 6.2**

6. From what you know about the product from the description, I would like you to tell me for each price (show below) whether you would buy or would not buy at that price.

Price	$3.50	$4.00	$5.00	$6.50	$7.20
Would buy	a	b	c	d	e
Would not buy	n	n	n	n	n

7. Which of the phrase below best describe your opinion on the appearance of the product?
   - ☐I think , I like the appearance very much
   - ☐I think, I quite like the appearance
   - ☐I think, I neither like or dislike the appearance
   - ☐I think, I dislike the appearance
   - ☐I think , I strongly dislike the appearance

8. Which of the phrase best describes your opinion on the flavour of the product?
   - ☐I feel, I like the flavour very much
   - ☐I feel, I quite like the flavour
   - ☐I feel, I neither like or dislike the flavour
   - ☐*I feel dislike the flavour
   - ☐*I feel, strongly dislike the flavour

If dislike/strongly dislike: What did you dislike about the flavour?

_____

9. Which of the phrase best describe your opinion on the attractiveness of the product?
   - ☐Extremely attractive
   - ☐Very attractive
   - ☐Neither attractive or unattractive
   - ☐Very unattractive
   - ☐Extremely unattractive

10. Which of the phrase best describes how do you think about the product concept?
   - ☐Excellent
   - ☐Extremely excellent
   - ☐Very good
   - ☐Good
   - ☐Fair
   - ☐Poor

11. How likely are you to buy the product, if it is available at your supermarket compared your regular product?
   - ☐Definitely buy
   - ☐Probably buy
   - ☐Might buy or might not buy
   - ☐Probably not buy
   - ☐Definitely not buy

Continued **Appendix 6.2**

SET B.

Instruction: Could you please look and taste the prototypes infront of you. Then answer all the questions in Set B.

1. What did you think of it overall?

_____

_____

2. And was the product as you expected it would be, or was it different?

As expected_____

Different_____

2a. In what ways it different?

_____

3. And was it better or worse than you expected.

- ☐Much better
- ☐A little better
- ☐A little worse
- ☐Much worse

4. What if anything did you particularly like about the product?

_____

5. What if anything did you particularly dislike about the product?

_____

6. Would you list the prototypes in order of your preference.
(4=most preferable, 1=less preferable)

4-

3-

2-

1-

7. From what you know about the product from the description, I would like you to tell me for each price (show below) whether you would buy or would not buy at that price.

Price	$3.50	$4.00	$5.00	$6.50	$7.20
Would buy	a	b	c	d	e
Would not buy	n	n	n	n	n

Continued **Appendix 6.2**

8. Which of the phrase best describes your opinion on the appearance of the product?
   - ☐I like the appearance very much
   - ☐I quite like the appearance
   - ☐I neither like or dislike the appearance
   - ☐I dislike the appearance
   - ☐I strongly dislike the appearance

9. Which of the phrase best describes your opinion on the flavour of the product?
   - ☐I like the flavour very much
   - ☐I quite like the flavour
   - ☐I neither like or dislike the flavour
   - ☐*I dislike the flavour
   - ☐*I strongly dislike the flavour

If dislike/strongly dislike: What did you dislike about the flavour?

---

10. Could you please list the prototypes in order of your preference.
    (4=most preferable, 1=less preferable).

    4-
    3-
    2-
    1-

11. Which of the phrase best describe your opinion on the attractiveness of the product?
    - ☐Extremely attractive
    - ☐Very attractive
    - ☐Neither attractive or unattractive
    - ☐Very unattractive
    - ☐Extremely unattractive

12. Which of the phrase best describes how do you think about the product concept?
    - ☐Excellent
    - ☐Extremely excellent
    - ☐Very good
    - ☐Good
    - ☐Fair
    - ☐Poor

13. How likely are you to buy the product, if it is available at your supermarket compared your regular product?
    - ☐Definitely buy
    - ☐Probably buy
    - ☐Might buy or might not buy
    - ☐Probably not buy
    - ☐Definitely not buy

Appendix 6.3: The Statistic Analysis of Concept Testing.

	Average	Std. Deviation	P-value
a. THE CHANGES OF PREFERENCE WHEN THE CONCEPT PROTOTYPES WERE SHOWN.			
1. Product Appearance Preference.			0.21
Changing in preference	18.5	4.95	
Not changing in preference	9.5	4.95	
2. Product Flavour Preference			1.0
Changing in preference	14	1.41	
Not changing in preference	14	1.41	
3. Product Attractiveness Preference			0.014
Changing in preference	20	1.41	
Not changing in preference	8	1.41	
4. Price Preference			0.005
Changing in preference	81	4.24	
Not changing in preference	19	4.24	
5. Buying Intention.			0.051
Changing in preference	15.5	0.707	
Not changing in preference	12.5	0.707	
b. THE CHANGES OF PREFERENCE WHEN THE CONCEPT PROTOTYPES WERE SHOWN BETWEEN FOCUS GROUP AND SURVEY TECHNIQUE.			
1. Product Appearance Preference.			1.0
Changing in preference	14	1.41	
Not changing in preference	14	11.3	
2. Product Flavour Preference			1.0
Changing in preference	14	1.41	
Not changing in preference	14	1.41	
3. Product Attractiveness			1.0
Changing in preference	14	7.07	
Not changing in preference	14	9.9	
4. Price Preference			
Changing in preference	50	39.6	1.0
Not changing in preference	50	48.1	
5. Buying Intention			
Changing in preference	14	2.83	1.0
Not changing in preference	14	1.41	

Continued **Appendix 6.3**

	Average	Std. Deviation	P-value
c. Product Concept Preference.			
1. Focus Group.			
Concept description	69.75	10.34	1.0
Concept prototype	69.75	17.4	
Concept description	69.75	10.34	0.844
Concept prototype (taste)	97.25	22.08	
Concept prototype	69.75	17.4	0.865
Concept prototype (taste)	67.25	22.08	
2. Survey Technique.			
Concept description	70.25	13.62	0.965
Concept prototype	69.5	29.74	
Concept description	70.75	13.62	1.0
Concept prototype (taste)	70.75	28.27	
Concept prototype	69.5	29.74	0.972
Concept prototype (taste)	70.25	28.27	
3. Concept Description.			
Focus group	69.75	10.34	0.955
Survey technique	70.25	13.62	
4. Concept Prototype			
Focus group	69.75	17.4	0.989
Survey technique	69.5	29.74	
5. Concept Prototype (taste)			
Focus group	67.25	22.08	0.873
Survey technique	70.25	28.27	

Appendix 6.4: Sequence of questions in Focus Group session.

a. Product Concept Description Discussion.

* What do you think about the product after you read the product concept descriptions?
*What do you think about the fruit combination in the product concepts descriptions?
- What do you that.....
* Is the product different from the existing product?
a. Same, in what way?
b. Different, in what way?
*Who do you think, the target market for this product?
*Why do you choose this group as the product target market?
*Among the four product concept descriptions, which one do you think the most preferable for Malaysian?
*Why do you think this product concept was preferable among the Malaysian?

b. Product Prototypes.

*Do you think the description of the product concept describe the product very well?
*What do you think as overall about the product prototypes?
*What do think about the fruit combination of each product prptotypes?
*What about the flavour combination of the product prototypes?
- Should sugar be added to the product to increase the sweetness of the product?
* What if anything did you particularly like about the product?
* If any modification should be done, what it is?
*What do you think the suitable range of price for this product?
*Do you think this product can be market in Malaysia?
-Why do you say that.....
*Is there anything you want to say about this product?
*Is there anything you want to say about the product concept?

Appendix 6.5: Changes in Purchasing Price Preference between Concept Description and Concept Prototype in Focus Group

		Concept Prototype						
		$3.50	$4.00	$5.00	$6.50	$7.20	Wouldn't not buy	
Concept Descript.	$3.50	25(26%)					1(1%)	26(27%)
	$4.00		20(21%)				2(2%)	22(23%)
	$5.00			12(12%)			1(1%)	13(13%)
	$6.50				2(2%)		2(2%)	4(4%)
	$7.20					2(2%)	1(1%)	3(3%)
	Wouldn't not buy	1(1%)	6(6%)	8(8%)	8(8%)	6(6%)		29(29%)
		26(27%)	26(27%)	20(20%)	10(10%)	8(8%)	7(7%)	97(100%)

Changes in Purchasing Price Preference between Concept Description and Concept Prototype in Survey Method

		Concept Prototype						
		$3.50	$4.00	$5.00	$6.50	$7.20	Wouldn't not buy	Total
Concept Descript	$3.50	20(35%)					2(3%)	22(36%)
	$4.00		15(25%)				1(2%)	16(27%)
	$5.00			5(8%)				5(8%)
	$6.50				1(2%)		1(2%)	2(3%)
	$7.20						2(3%)	2(3%)
	Wouldn't not buy	3(5%)	4(6%)	5(8%)	1(2%)	1(2%)		14(23%)
	Total	23(38%)	19(31%)	10(16%)	2(3%)	2(3%)	1(2%)	61(100%)

DESCRIPT = Description

Appendix 7.1.

SNACK FRUIT SENSORY TESTING

Name:..... Date:.....

1. There are six product samples for you to evaluate, could you please list the product samples according to your preferences. (6- the most prefereable, 1-less prefereable).

6.....
5.....
4.....
3.....
2.....
1.....

2. Can you indicate which of the product samples is the best with the product concept description below

Introducing new dehydrated snack fruit, the delightful snack fruit with natural taste that combines variety of fruit slices such as Apple, Kiwifruit, Strawberry, Banana, Pinepaple, and Jackfruit. The new dehydrated snack fruit will provide you with vitamins, mineral and fiber you need for your days. A versatile snack fruit can be used in cooking as well as breakfast cereal or served as a snack for leisure, parties and between meals. The product will be packaged in laminated aluminium and plastic packaging that is so convenient for you. With the new dehydrated snack fruit, you can taste the exotic of tropical fruit and the freshness of New Zealand fruit in one pack.

Sample code:.....

Continued **Appendix 7.1**

3. Please mark the product codes as well as your ideal sample (I) at the position on the line that best reflects your attitude about the product attributes.

Note: Please ensure you rinse your mouth with plain water, before testing each sample.

Example: Thickness.

not thick	very thick

a. The colour of fruit combination

very unattractive	very attractive

b. The appearance of the snack fruit

very unacceptable	very acceptable

c. The flavour of the snack fruit

not sweet	very sweet

d. The texture of the snack fruit

not crispy	very crispy

e. Overall acceptability

dislike extremely	like extremely

4. What if anything did you particularly like about your first preference?

.....

5. What if anything did you particularly dislike about your last preference?

.....

Appendix 7.2. Results of Sensory Evaluation between Wanganui Polytechnic students and Massey University students

	Mean	Std. Deviation	P-value
a. Result of sensory evaluation without eliminating the 'outsider' score.			
1. Colour.			0.478
Wanganui students	0.75	0.13	
Massey students	0.66	0.07	
2. Taste			0.301
Wanganui students	1.53	7.5	
Massey students	0.73	0.06	
3. Texture			0.99
Wanganui students	0.71	0.04	
Massey students	0.71	0.04	
4. Appearance			0.0018
Wanganui students	1.18	0.19	
Massey students	0.7	0.03	
5.Overall acceptability.			0.008
Wanganui students	0.82	0.03	
Massey students	0.65	0.013	
b. Result of sensory evaluation with eliminating the 'outsider' score on appearance and overall acceptability.			
1. Appearance			0.968
Wanganui students	0.70	0.23	
Massey students	0.7	0.16	
2.Overall acceptability.			0.073
Wanganui students	0.76	0.17	
Massey students	0.65	0.11	

Appendix 7.3

Results of Consumer Panel Preference.

Sample no. / Respodents	419	429	439	449	459	469	479	489	499	491	492	493
1	6	3	1	6	2	2	1	5	4	4	3	3
2	5	6	6	5	1	1	4	3	4	2	2	4
3	5	6	6	3	1	1	2	4	5	3	2	2
4	5	6	6	4	1	1	4	5	2	3	3	5
5	4	6	6	1	1	5	2	4	2	3	3	2
6	4	5	4	6	3	1	5	3	2	1	3	5
7	3	6	6	1	1	4	2	5	2	4	2	5
8	4	6	3	3	6	1	5	6	1	4	6	5
9	2	2	6	3	2	3	1	5	4	1	5	3
10	1	4	6	4	1	2	2	6	5	3	6	4
11	2	4	5	5	1	2	1	6	3	3	4	5
12	4	4	2	3	1	3	2	6	1	6	6	6
13	2	5	5	3	2	1	4	5	1	5	2	1
14	2	4	3	4	4	5	3	6	5	6	5	5
15	3	3	3	2	2	6	1	6	4	4	2	2
16	5	2	1	1	6	1	4	3	6	5	3	2
17	5	5	6	1	4	4	6	4	3	6	2	3
18	4	4	6	5	1	3	5	6	2	1	4	1
19	4	5	6	5	2	2	4	6	3	1	1	2
20	3	5	1	4	1	3	3	6	5	2	1	5
Total	73	91	88	69	43	51	61	100	64	67	65	70

Appendix 7.4: Results Sensory Evaluation

Sample	Panel	Colour	Taste	Texture	Fruit mixture	Overall acceptability
1	1	0.95	0.54	0.97	1.08	0.61
1	2	1.88	1.92	0.14	0.55	0
1	3	1.37	0.68	1.03	0	1.04
1	4	1.75	0.11	0.43	0.89	0.22
1	5	0.96	0.99	0.47	0.88	0.92
1	6	0.94	0.75	1.07	0.95	0.79
1	7	0	1.62	0.01	0.15	0.25
1	8	1.44	0.68	0.93	1	1.27
1	9	0.61	0.9	0.73	0.54	0.93
1	10	0.07	0.75	0.91	0.55	0.733
1	11	0.61	1.07	0.31	0.84	0.61
1	12	0.87	0.86	0.39	0.47	0.76
1	13	0.75	0.41	0.46	0.88	0.63
1	14	1.05	0.35	0.47	0.65	0.36
1	15	0.84	0.8	0.78	0.88	0.53
1	16	1.29	1.15	0.89	1.15	0.81
1	17	0.7	1.3	1.03	0.72	0.93
1	18	0.55	0.3	0.75	0.51	0.21
1	19	0.8	0.51	1.23	0.38	0.74
1	20	0.38	0.25	0.67	0.75	0.42
Total		17.79	15.94	13.67	13.82	12.76
Average		0.89	0.8	0.68	0.69	0.64
Std. Deviation		0.47	0.45	0.33	0.30	0.32

Sample	Panel	Colour	Taste	Texture	Fruit mixture	Overall acceptability
2	1	0.62	0.21	0.03	0.65	0.43
2	2	2.17	1.64	1.97	1.3	0
2	3	1.32	0.61	1.23	0	1.12
2	4	2.01	1.09	0.87	1.1	0.87
2	5	1.11	1.17	0.97	1.03	1
2	6	1.1	1.21	0.56	1.09	0.97
2	7	0.72	0.42	1.01	0.77	0.91
2	8	1.29	0.68	0.75	1.23	1.61
2	9	1.43	0.75	0.77	1.28	0.43
2	10	0.76	0.44	0.8	0.98	0.67
2	11	0.79	0.89	0.43	0.81	0.58
2	12	0.78	0.88	0.8	0.72	0.74
2	13	1.28	0.83	0.85	0.9	0.96
2	14	0.55	0.04	0.63	0.7	1
2	15	0.7	0.67	0.57	0.69	0.61
2	16	0.91	0.67	0.61	1.2	0.38
2	17	0.95	1.13	0.89	1.14	1.04
2	18	0.43	0.38	0.79	0.51	0.28
2	19	0.82	1.12	1.26	0.68	0.44
2	20	0.75	0.7	1.17	0.89	0.76
Total		20.49	15.53	16.96	17.67	14.8
Average		1.02	0.78	0.85	0.88	0.74
Std.deviation		0.46	0.38	0.39	0.31	0.36

Continues **Appendix 7.4**

Sample	Panel	Colour	Taste	Texture	Fruit mixture	Overall acceptability
3	1	0.25	0.95	0.77	0.82	0.61
3	2	2.17	1.76	0.43	1.3	0
3	3	1.39	0.3	0.61	0	0.76
3	4	2.01	0.79	0.43	1.1	0.68
3	5	1.15	1.05	0.74	1.05	0.96
3	6	1.04	1.35	0.44	0.87	1.07
3	7	0.95	1.76	0.26	0.89	0.63
3	8	1.44	1.35	1.1	1.35	1.74
3	9	1.61	1.22	1.13	1.51	0.94
3	10	0.92	1.09	0	1	0.91
3	11	0.94	0.59	0.34	0.97	0.84
3	12	1.05	0.81	0.83	0.91	1
3	13	1.38	0.72	0.77	0.96	1.12
3	14	1.18	0.04	0.57	0.77	0.48
3	15	0.65	1.06	0.87	0.74	0.9
3	16	1.1	0.8	1.07	0.84	0.46
3	17	1.14	0.92	1.06	1.03	0.9
3	18	0.66	0.62	0.68	0.77	0.61
3	19	0.94	0.68	1.21	0.82	0.39
3	20	0.82	0.65	0.86	1.01	0.89
Total		22.79	18.51	14.17	18.71	15.89
Average		1.14	0.93	0.71	0.94	0.79
Std.deviation		0.45	0.43	0.32	0.30	0.35

Sample	Panel	Colour	Taste	Texture	Fruit mixture	Overall acceptability
4	1	1.02	0.51	0.07	1.11	0.97
4	2	0.65	1.24	1.77	0.37	0
4	3	0.31	0.64	0.87	0	0.25
4	4	1.19	0.27	0.66	0.47	0.33
4	5	0.22	0.96	0.63	0.21	0.77
4	6	0.26	0.9	0.71	0.65	0.67
4	7	0.2	0.08	0.89	0	0.03
4	8	0.77	0.48	1.1	1.23	1.46
4	9	0.76	0.73	0.89	0.88	0.64
4	10	1.45	0.51	0.99	0.81	0.83
4	11	0.79	1.17	0.39	0.68	0.52
4	12	1.08	0.74	0.51	0.96	0.54
4	13	0.65	0.5	0.46	0.93	0.81
4	14	0.88	0.15	0.63	0.93	0.19
4	15	0.37	0.92	0.91	0.52	0.65
4	16	1.14	0.47	0.75	1.23	0.24
4	17	0.84	0.38	0.48	0.83	0.42
4	18	0.41	0.5	0.68	0.62	0.44
4	19	0.73	0.96	0.125	0.38	1.07
4	20	0.38	0.54	0.53	1.17	0.53
Total		14.1	12.65	14.045	13.98	11.36
Average		0.71	0.63	0.70	0.70	0.57
Std.deviation		0.36	0.32	0.37	0.38	0.36

Continued **Appendix 7.4**

Sample	Panel	Colour	Taste	Texture	Fruit mixture	Overall acceptability
5	1	0.03	0.05	0.19	0.1	0.05
5	2	0.28	0.14	1.23	0.18	0
5	3	0.36	0.23	0.73	0	0.44
5	4	0.36	0.27	0.11	0.17	0.33
5	5	0.27	1.06	0.6	0.27	0.69
5	6	0.2	1.08	0.82	0.48	0.41
5	7	0.07	0.23	0.14	0.42	0.16
5	8	1.16	1.5	1.47	1.11	1.46
5	9	0.44	1.04	1.04	0.77	0.83
5	10	0.26	0.59	0.51	0.47	0.44
5	11	0.57	1.02	0.47	0.61	0.55
5	12	0.52	0.91	0.97	0.43	0.72
5	13	0.2	0.93	0.94	0.6	0.72
5	14	0.03	1.07	1.55	0.16	0.29
5	15	0.46	0.77	0.63	0.55	0.69
5	16	0.56	1.21	0.78	0.66	0.9
5	17	0.34	0.49	0.6	0.67	0.64
5	18	0.06	0.76	0.94	0.1	0.21
5	19	0.36	0.36	1.18	0.12	0.2
5	20	0.16	0.65	0.77	0.89	0.31
Total		6.69	14.36	15.67	8.76	10.04
Average		0.33	0.72	0.78	0.44	0.50
Std.deviation		0.26	0.41	0.40	0.30	0 34

Sample	Panel	Colour	Taste	Texture	Fruit mixture	Overall acceptability
6	1	0.07	0.03	0.95	0.24	0.05
6	2	0.28	0.14	0.14	0.18	0
6	3	0.69	0.84	1.29	0	0.9
6	4	0.36	1.39	1.09	0.17	1.09
6	5	0.31	1.13	0.18	0.33	0.88
6	6	0.15	0.82	0.9	0.26	0.51
6	7	0.41	1.23	0.5	0.65	0.5
6	8	0.32	0.48	0.93	0.84	0.84
6	9	0.97	1.08	1.58	0.94	0.41
6	10	0.21	0.95	0.23	0.19	0.8
6	11	0.73	0.72	0.5	0.63	0.72
6	12	0.67	0.88	0.86	0.54	0.69
6	13	0.7	0.88	0.89	0.46	0.65
6	14	0.78	1.2	0.88	0.24	0.77
6	15	0.78	0.88	0.93	0.9	1
6	16	0.44	0.92	0.72	0.56	0.61
6	17	0.55	0.79	0.83	0.78	0.78
6	18	0.14	0.84	0.89	0.25	0.37
6	19	0.57	0.59	1.21	0.4	0.33
6	20	0.19	0.22	0.42	0.44	0.31
Total		9.32	16.01	15.92	9	12.21
Average		0.47	0.80	0.80	0.45	0.61
Std.deviation		0.26	0.36	0.37	0.27	0.30

Continued **Appendix 7.4**

Sample	Panel	Colour	Taste	Texture	Fruit mixture	Overall acceptability
7	1	0.72	0.33	0.75	0.22	0.26
7	2	0.65	1.04	1.63	0.37	0
7	3	0.74	0.55	0.86	0	0.7
7	4	1.46	0.5	1.09	0.3	0.49
7	5	0.74	0.89	0.4	0.72	0.8
7	6	0.79	0.96	0.97	0.84	1.15
7	7	0.38	1.85	0.59	0.31	0.72
7	8	0.73	1.13	0.53	0.84	0.84
7	9	0.47	0.56	1.22	0.73	0.81
7	10	0.36	0	0.71	0.27	0.85
7	11	0.49	0.78	0.54	0.77	0.68
7	12	0.39	0.49	0.3	1.03	0.6
7	13	0.56	0.66	0.34	0.73	0.69
7	14	0.39	0.54	0.77	0.43	1.23
7	15	0.52	0.84	0.86	0.6	0.67
7	16	1.06	1.08	0.84	1.09	0.72
7	17	0.91	0.98	0.94	1.17	1.01
7	18	0.35	0.49	0.85	0.62	0.51
7	19	0.76	1.04	1.25	0.31	0.63
7	20	0.27	0.77	0.94	0.63	0.58
Total		12.74	15.48	16.38	11.98	13.94
Average		0.64	0.77	0.82	0.60	0.70
Std.deviation		0.29	0.38	0.33	0.32	0.28

Sample	Panel	Colour	Taste	Texture	Fruit mixture	Overall acceptability
8	1	0.82	0.35	0.25	0.63	0.43
8	2	1.32	2.64	1.23	1.16	0
8	3	0.86	0.16	0.35	0	0.54
8	4	1.75	0.5	0.87	0.89	0.49
8	5	0.91	0.92	0.83	0.79	0.66
8	6	0.52	1.1	0.95	1.07	0.81
8	7	0.78	1	0.33	0.99	0.58
8	8	0.32	1.35	0.75	0.71	1.09
8	9	1.2	1.69	1.42	1.34	1.07
8	10	0.85	0.88	0.97	0.85	1
8	11	0.9	0.93	0.82	0.95	0.87
8	12	1.44	0.69	0.73	1.1	0.84
8	13	1.17	0.62	0.58	0.81	0.92
8	14	1.28	1.37	1	1	1.62
8	15	1	0.5	0.47	1	0.85
8	16	1.19	0.95	1.04	1.03	0.52
8	17	1.05	0.73	0.78	1.08	0.69
8	18	0.53	0.68	0.75	0.77	0.61
8	19	0.86	0.81	1.23	0.82	0.91
8	20	0.82	0.7	1.33	0.96	0.89
Total		19.57	18.57	16.68	17.95	15.39
Average		0.98	0.93	0.83	0.90	0.77
Std.deviation		0.34	0.54	0.33	0.27	0.33

Continued **Appendix 7.4**

Sample	Panel	Colour	Taste	Texture	Fruit mixture	Overall acceptability
9	1	0.34	0.76	0	0.08	0.77
9	2	1.66	2.24	0.56	0.81	0
9	3	0.85	0.47	0.2	0	1.07
9	4	1.46	0.11	0.16	0.3	0.22
9	5	0.12	0.87	0.1	0.06	0.53
9	6	0.83	0	0.08	0.75	0.92
9	7	0.59	0.51	0.12	0.52	0.43
9	8	1.29	0.89	0.13	1.35	1.61
9	9	0.94	0.8	0.17	1.23	0.49
9	10	0.56	0.91	0.11	0.78	0.99
9	11	0.84	0.78	0.05	0.91	0.8
9	12	0.73	0.8	0.11	0.4	0.73
9	13	0.85	0.57	0.12	0.64	0.75
9	14	1.32	0.74	0.11	0.84	0.65
9	15	0.96	0.56	0.06	0.8	0.93
9	16	1.26	1.27	0.07	1.3	1
9	17	0.92	0.96	0.14	0.96	0.83
9	18	0.27	4.76	0.11	0.25	0.51
9	19	0.66	0.87	0.16	0.64	0.54
9	20	0.73	0.39	0.18	0.68	0.67
Total		17.18	19.26	2.74	13.3	14.44
Average		0.86	0.96	0.14	0.67	0.72
Std.deviation		0.40	1.00	0.11	0.40	0.34

Sample	Panel	Colour	Taste	Texture	Fruit mixture	Overall acceptability
10	1	0.41	0.79	0.38	0.42	0.97
10	2	1.32	2.4	0.43	0.98	0
10	3	0.58	0.43	0.63	0	0.83
10	4	0.67	0.79	0.66	0.61	0.68
10	5	0.37	1.1	0.76	0.39	0.76
10	6	0.43	1.31	0.88	0.71	0.66
10	7	0.51	1.4	0.72	0.25	0.7
10	8	0.77	1.13	1.31	0.71	1.74
10	9	0.27	0.84	1.18	0.23	0.55
10	10	0.16	0.35	0.89	0.34	0.57
10	11	0.65	1.1	0.29	0.7	0.63
10	12	0.82	0.94	0.93	0.63	0.64
10	13	0.8	0.32	0.7	0.53	0.87
10	14	0.72	0.89	1.42	0.32	1.38
10	15	0.55	0.58	0.8	0.61	0.5
10	16	0.71	1.05	0.49	0.76	0
10	17	0.45	0.85	1.11	0.88	1.09
10	18	0.1	0.46	0.87	0.1	0.37
10	19	0.12	0.77	1.18	0.24	0.3
10	20	0.26	0.54	0.67	0.51	0.5
Total		10.67	18.04	16.3	9.92	13.74
Average		0.53	0.90	0.82	0.50	0.69
Std.deviation		0.29	0.47	0.31	0.26	0.41

Continued **Appendix 7.4**

Sample	Panel	Colour	Taste	Texture	Fruit mixture	Overall acceptability
11	1	0.59	0.19	0.6	0.4	0.26
11	2	1.88	0.56	0.74	0.61	0
11	3	1.18	0.72	0.76	0	0.91
11	4	0.67	1.09	0.11	0.61	0.87
11	5	0.41	0.72	0.71	0.45	0.48
11	6	0.65	1.17	1.14	0.53	0.59
11	7	1	1.4	1.2	0.73	1
11	8	1	1.5	1.31	1.05	1.27
11	9	1.37	1.18	1.09	1.43	1.17
11	10	0.69	1.19	0.94	0.6	0.95
11	11	0.87	0.82	0.27	0.87	0.78
11	12	0.92	0.83	0.44	0.68	0.8
11	13	0.92	0	0.44	0.68	0.81
11	14	1.05	1.83	0.38	0.6	1
11	15	0.88	0.97	0.73	0.82	0.81
11	16	1.34	0.44	0.94	1.05	0.28
11	17	0.77	0.64	0.4	0.93	0.36
11	18	0.33	0.8	0.75	0.38	0.28
11	19	0.47	1.09	1.26	0.55	1.07
11	20	0.97	0.61	0.63	0.74	0.64
Total		17.96	17.75	14.84	13.71	14.33
Average		0.90	0.89	0.74	0.69	0.72
Std.deviation		0.36	0.44	0.34	0.30	0.34

Sample	Panel	Colour	Taste	Texture	Fruit mixture	Overall acceptability
12	1	0.77	0.98	0.57	0.88	0.78
12	2	1.66	0.64	0.74	1.16	0
12	3	0.46	0.32	1.08	0	0.6
12	4	1.19	1.39	0.26	0.47	1.09
12	5	0.52	1.04	0.86	0.54	0.86
12	6	0.85	0.87	0.44	0.59	0.54
12	7	0.24	0.72	0.83	0.1	0.35
12	8	0.73	0.89	0.53	1	1.09
12	9	0.71	0.92	0.87	0.45	0.69
12	10	0.89	0.84	0.04	0.12	0.53
12	11	0.7	0.64	0.71	0.59	0.73
12	12	0.61	0.89	0.66	0.32	0.67
12	13	0.47	0.75	0.63	0.54	0.75
12	14	0.23	1.56	1.3	0.1	0.88
12	15	0.75	1	0.62	0.78	0
12	16	0.96	0.58	0	0.96	0.32
12	17	0.39	0.57	0.72	0.39	0.48
12	18	0.24	0.5	0.38	0.38	0.43
12	19	0.02	1.2	1.28	0.18	0.06
12	20	0.32	0.32	0.53	0.51	0.39
Total		12.71	16.62	13.05	10.06	11.24
Average		0.64	0.83	0.65	0.50	0.56
Std.deviation		0.38	0.32	0.34	0.33	0.32

Appendix 7.5: Results of Physical Testing

Sample	Replicate	Moisture content(%)	L*	a*	b*	Sugar content (Brix)
1	1	1.60	71.79	9.33	14.1	13.5
2	1	1.60	76.98	10.37	16.86	12
3	1	1.80	69.74	8.65	19.04	10.5
4	1	1.59	78.27	9.36	15.53	11
5	1	1.80	79.16	0.11	15.28	10
6	1	1.20	80.85	-0.28	21.77	9.5
7	1	1.60	72.25	8.55	18.11	10
8	1	1 99	71.45	8.66	23.33	10
9	1	1.80	74.95	7.36	16.04	12
10	1	1.99	76.92	0.37	17.58	13
11	1	1.40	75.67	4	16.95	15
12	1	1.60	74.16	-1.02	22.02	13
Total		19.95	902.19	65.46	216.61	139.50
Average		1.66	75.1825	5.46	18.05	11.63
Std.deviation		0.23	3.420816	4.47	2.94	1.73

Sample	Replicate	Moisture content(%)	L*	a*	b*	Sugar content (Brix)
1	2	1.80	74.62	9.03	13.64	11.5
2	2	1.80	73.52	10.2	16.47	14
3	2	1.60	70.12	8.66	19.1	12.5
4	2	1.60	76.34	9.5	15.45	11
5	2	1.39	76.66	-0.09	15.52	10
6	2	1.20	76.2	0.39	22.93	8.5
7	2	1.60	70.63	0.37	17.17	10.5
8	2	1.79	72.74	7.37	23.51	9.5
9	2	1.60	75.1	7.68	16.77	12.5
10	2	1.40	81.42	0.24	17.98	13
11	2	1.20	74.73	4.2	16.27	14.5
12	2	1.00	73.72	-0.81	21.13	14.5
Total		17.97	895.80	56.74	215.94	142.00
Average		1.50	74.65	4.73	18.00	11.83
Std.deviation		0.26	2.98	4.42	3.09	1.99

Appendix 8.1: The Final Consumer Testing of Product.

Questionnaire.

I am postgraduate student at Faculty of Food Technology, Massey University, I'm conducting a consumer test on dried snack fruit. The dried snack fruit is specially designed for Malaysian. I would like you to taste the dried snack and answer s few questions. (Please tick your answer at the appropriate box below)

1. Do you like the flavour of dried snack fruit?

- ☐Like extremely
- ☐Like moderately
- ☐Neither like nor dislike
- ☐Dislike moderately
- ☐Dislike extremely

2. Do you like the fruit colour combination of dried snack fruit?

- ☐Like extremely
- ☐Like moderately
- ☐Neither like nor dislike
- ☐Dislike moderately
- ☐Dislike extremely

3. In general, how do you like the dried snack fruit?

- ☐Like extremely
- ☐Like moderately
- ☐Neither like nor dislike
- ☐Dislike moderately
- ☐Dislike extremely

4. When do you think you would eat the dried snack fruit?

- ☐As a dessert
- ☐As a breakfast cereal
- ☐In cooking
- ☐Between meal
- ☐Parties
- ☐Serve on the special occasion
- ☐Other (Please specify)_____

_____

5. What is the maximum price would you be prepared to buy for the dried snack fruit for 40gm net?

- ☐$5.50
- ☐$5.00
- ☐$4.50
- ☐$3.50
- ☐$3.00
- ☐$2.50

Continued **Appendix 8.1**

6. If the dried snack fruit will cost $2.50/40gm, would you be ..... in buying this product?

- ☐Very interested
- ☐Moderate interested
- ☐Neither interested nor not interested
- ☐Moderate not interested (Go to question 10)
- ☐Very not interested

7. How much would you like to pay for the dried snack fruit?

_____

8. If the price were $2.50/40gm, how often do you think you would buy the dried snack fruit?

- ☐More than once a week
- ☐Once a week
- ☐Once a fortnight
- ☐Once a month
- ☐Less than once a month

9. How interested would you be in buying the product if it were available at your supermarket?

- ☐Definitely buy
- ☐Probably buy
- ☐Might buy or might not buy
- ☐Probably not buy
- ☐Definitely buy

10. Age, sex, and ethnic group of person filling the questionnaires.

Age(years)	Sex	Ethnic Group
☐18-20	☐Male	☐Malay
☐21-24	☐Female	☐Non-Malay
☐25-30		
☐Over 30		

Appendix 8.2

Statistic Analysis of Final Consumer Testing

	No. of Respondents		
a) Overall acceptability	Flavour	Colour combination	Overall acceptability
Like extremely	16	12	11
Like moderately	30	41	33
Neither like nor dislike	12	7	13
Dislike moderately	7	3	3
Dislike extremely	1	1	4
Average	13.2	12.8	12.8
Std. deviation	10.94	16.32	12.09

b) Maximum price the respondents willing to pay	No. of respondents
$5.50	0
$5.00	1
$4.50	4
$3.50	10
$3.00	18
$2.50	31
Average	10.67
Std. deviation	12.07

c) Purchase intention at the price of $2.50 Very interested	No. of respondents
Moderate interested	15
Neither interested nor	29
not interested	12
Moderate not interested	3
Very not interested	5
Average	12.8
Std. deviation	10.31

d) Usage pattern	No. of respondent
As a dessert	15
As a breakfast cereal	20
In cooking	0
Between the meal	26
Parties	28
Serve on the special occasion	9
While watching tv/ movie	3
Picnic	1
When wanted to taste something new	5
Average	11.89
Std. Deviation	10.49

e) Frequency of buying pattern	No. of respondents
More than once a week	11
Once a week	13
Once a fortnight	13
Once a month	13
Less than once a month	5
Average	11
Std. Deviation	3.46

f) Buying intention	No. of respondents
Definitely buy	15
Probably buy	28
Might buy or might not buy	12
Probably not buy	1
Definitely not buy	0
Average	14
Std. Deviation	11.11