Comparison Effects of Sweetener on Perceived Aftertaste in Flavored Beverages Products

BY
Keletso Carol Seetso
ID: 513-5788

A special project submitted to the faculty of Biotechnology, Assumption University in part of the requirements for the degree of Bachelor of Science in Biotechnology
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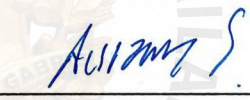
Level of Study	: Bachelor of Science
Department	: Food Technology
Faculty	: Biotechnology
Academic Year	: 2012



Dr. Aussama Soontrunnarudrungsri

(Advisor)

ACKNOWLEDGEMENTS

First and foremost, I would like to express my sincerest gratitude to my advisor, Dr. Aussama Soontrunnarudrungsri, for her tremendous support while still giving me space to work at my own pace. It was a great opportunity to work with her and further improve my knowledge in this field of sensory food technology.

My deepest appreciation also goes to Mr. Stijn Dessel, Ms. Marceline Kashiri, Ms. Marike Menchen and Ms. Tumisang Nguvauva for their assistance in preparation of the beverages and recruiting volunteer tasters. Their willingness to give their valuable time towards the completion of this project is duly noted.

This project would not have been possible without the resources from Faculty of Biotechnology, Assumption University. From the lecturers' advice, sensory laboratory in E1 and equipments such as scales and disposable cups to updated journals, I am eternally thankful for the assistance.

Lastly, I would like to acknowledge all the consumers who agreed to partake in the sampling of the beverage tests and filling out the questionnaires.

Keletso Carol Seetso

ABSTRACT

Sugar replacers such as Stevia (*Stevia Rebaudiana*) are fast replacing sugar because of their added benefits. However, Stevia is known to have an astringent aftertaste which consumers might not accept. Therefore, a comparison was carried out to see the perceived aftertaste of Stevia and sugar in flavored beverage products according to consumers. A preliminary experiment was carried out to investigate the proper formulation of beverages in terms of sugar to Stevia ratio as well as in terms of flavor concentration. Stevia that is 200 times sweeter than sugar was closer in means for sweetness intensity scores (6.1) to sugar (7.6).As for flavor concentration formulation, no significant difference was observed for the overall liking score ($p<0.05$) therefore the lowest formulation (0.025%) was used to save costs. According to the consumer perception tests aftertaste is not significantly different across all 8 treatments. However all the other character notes being sweetness intensity, bitterness, astringency and overall liking which were being investigated had a significant difference. At ($p<0.05$) strawberry with sugar was liked most (6.0), Lemon with Stevia recorded the highest bitterness (0.7) and Green tea with Stevia was the most astringent (0.6).The results grouping was more according to sweetener than to flavor. All sugar flavored beverages could be put in the same class which was different from Stevia flavored beverages. For interaction effects, bitterness was significantly different in Stevia sweetened beverages. Consumers' behavior was assessed by the use of Likert-type scales such as food neophobia scale, food involvement scale and health and taste attitude scale. No differences in gender for food involvement and neophobia noted. As for the general health and taste attitude scale, males had a higher mean (4.4) as well as on the taste subscales (4.6) at ($p<0.05$).Furthermore, on the subscales, the individual scales had no significant differences except for light product interest, with males having a higher mean than females.

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INTRODUCTION

Nowadays, many people are turning towards nature and seek food or food ingredients that are both healthy and tasty. Of recent the use of sugar substitutes has increased due to the rejection and negative portrayal of sugar sweetened beverages by many researches (Kroger et al,2006). The rise of obesity and type 2 diabetes in Thailand parallels the increase in sugar-sweetened soft drink consumption. According to research by Promdee L, et al (2007) sugar consumption in Thailand is higher than WHO recommendation and this has been associated with dental caries and obesity. However this phenomenon is not only in Thailand, it is worldwide. In America, a study found the odds ratio of becoming obese increased 1.6 times for each additional sugar-sweetened drink consumed every day (Apovian,, 2004) .

The plant-derived sweetener known as Stevia is now widely available and rapidly replacing artificial sweeteners in consumer products. It is thirty times sweeter than sugar and has no effect on blood sugar. It has become an alternative to calorie conscious consumers who want to enjoy sweet taste with no added calories or glycemic response. Moreover Stevia is now considered generally recognized as safe or GRAS by FDA. (Curry et al,2008) reported no reproductive toxicity in rats exposed to the sweetener for two generations.Two human studies showed that 1,000 milligrams of Rebaudioside A per day was safe for healthy adults, as well as those with Type 2 diabetes (Maki et al,2008).One concern about Stevioside is the aftertaste associated with it. (Tanaka, 1997) wrote that, though sweet, the powder also had a bitter aftertaste (mostly attributed to a compound found in the Stevia plant called Stevioside), which limits its acceptability as a sugar substitute for the sensory conscious consumer. There seems to be limited research on how flavor can affect aftertaste but the general idea seems to be that some flavors can disguise or enhance aftertaste more than others. Mona et. al (2005) carried out a research to investigate how the aftertaste can be minimized by mixing Stevioside with other sweeteners so that their synergistic effects can reduce the undesirable aftertaste. Another concern about Stevia is consumer acceptance of beverages when they are sweetened with it instead of sugar. Elkins (1997) suggests that although Stevia has a characteristic aftertaste, it is more likely

to be accepted by consumers due to the fact that it is more natural than other sweeteners such as Saccharin. Aftertaste seems to be a small factor when compared with the benefits of this natural sweetener.

Therefore, the aim of this research is to compare perceived intensity of aftertaste of the flavored beverages containing Stevioside and sucrose.

OBJECTIVES

1. To formulate four different flavored beverage including orange, strawberry, lime/lemon, and green tea beverages.
2. To compare perceived intensity of aftertastes between flavored beverages contain sucrose and Stevioside.

LITERATURE REVIEW

1. Sweeteners

Sweeteners or sugar substitutes are a food additive that duplicates the effect of sugar in taste, usually with less food energy. Some sugar substitutes are natural and some are synthetic. Those that are not natural are, in general, called artificial sweeteners. An important class of sugar substitutes is known as high-intensity sweeteners. These are compounds with many times the sweetness of sucrose, common table sugar. As a result, much less sweetener is required and energy contribution is often negligible. The sensation of sweetness caused by these compounds (the "sweetness profile") is sometimes notably different from sucrose, so they are often used in complex mixtures that achieve the most natural sweet sensation.
(http://www.fao.org/es/faodef/fdef03e.htm)

Under the name sweeteners, FAO includes products used for sweetening that are derived from sugar crops, cereals, fruits or milk, or that are produced by insects. This category includes a wide variety of monosaccharide's (glucose and fructose) and disaccharides (sucrose and saccharose). They exist either in a crystallized state as sugar, or in thick liquid form as syrups. The traditional sources of sugar are sugar cane and sugar beets. But in recent years, ever larger quantities of cereals (mainly maize) have been used to produce sweeteners derived from starch. In addition to sugar, molasses is also obtained with various degrees of sugar content. The by-product obtained from the extraction of sugar is called bagasse in the case of sugar cane, and beet pulp in the case of sugar beets.

2. Stevia

2.1 Definition

Stevioside, a high intensity non-nutritive sweetener, is extracted from the leaves of Stevia rebaudiana Bertoni, a sweet plant native to north-eastern Paraguay. It is a white, crystalline, odorless powder which is approximately 300 times sweeter than sucrose (Kroyer, 1999). Structurally, Stevioside (13-[2-O-b-D-glucopyranosyl-a-glucopyranosyl) oxy]kaur-16-en-19-oic-acid b-D-glucopyranosyl ester) is a glycoside with a glucosyl and a sophorosyl residue attached to the aglycone steviol, which has a cyclopentanonhydrophenanthrene skeleton. Stevioside and extracts of S. Rebaudiana leaves are commercially available and used in many countries including Japan and several South American countries as sweetener for a variety of food and beverages (Kinghorn and Soerjato, 1984). In the last few years, biomedical research, mainly in Asian countries, has demonstrated no significant toxic activities of Stevioside in a wide variety of biological systems and has confirmed its lack of mutagenic, toxic or carcinogenic compounds (Suttajit et al.,1993)

2.2 Composition of Stevia

Stevia rebaudiana accumulates more than 30 steviol glycosides in varying concentrations. Amounts of total steviol glycosides up to 20% of the dry leaf weight are reported (Brandle and Starratt, 1998).The best known steviol glycosides are Stevioside and Rebaudioside A, which have the highest content in the plant. Their concentrations vary widely depending on the genotype and cultivation conditions. For example, (Kennelly, 2002) described the yield of Stevioside from dried leaves varying from 5 to 22% and Rebaudioside A contents from 25 to 54%.(Ohta et al, 2010) described a yield of 9.2% Stevioside and of 61.6% Rebaudioside A, respectively, in the special species S. rebaudiana Morita, which was produced by selection and breeding of S. rebaudiana Bertoni.

2.3 Structure

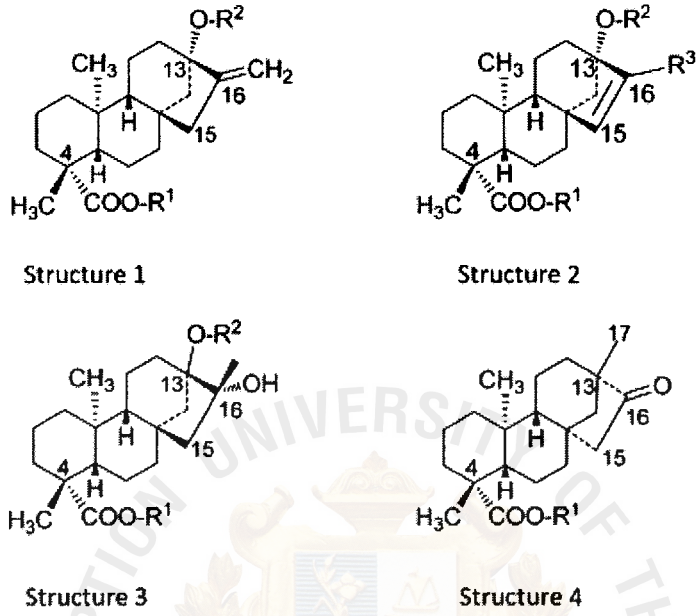

Figure 1. Four different kaurene body structures of steviol glycosides.

Source: Ursula Wölwer-Rieck (2012).

2.4 Stevia Common Use

Brandle and Telmer,(2007) found out that sweeteners derived from S. rebaudiana show great potential as zero-calorie sweeteners in the snack and quick-meal foods including more specifically in food products based on dried fruits. Such applications currently involve the addition of large amounts of sugar during the dehydration stages and coating of the dry fruit. Consequently, considerable caloric loads result in a fruit product that is sometimes viewed negatively by consumers, limiting consumer acceptance. Stevia is widely used as an artificial sweetener in many food products including cakes, beverages and even vinegar

2.5 Health and Safety

Studies have shown stevia to have a revitalizing effect on β-cells of pancreas,(Misra et al.,2011) improve insulin sensitivity in rats and possibly even to promote additional insulin production, helping to reverse diabetes and metabolic syndrome ,(Jeppesen,2004).Stevia consumed before meals significantly reduced postprandial insulin levels compared to both aspartame and sucrose and a 2010 review study in Food Journals by Goyal and colleagues concluded that stevia sweeteners would likely benefit diabetic patients. (Goyal et al.2010)

In 2006, the World Health Organization (WHO) performed a thorough evaluation of recent experimental studies of stevioside and steviols conducted on animals and humans, and concluded "Stevioside and Rebaudioside A are not genotoxic *in vitro* or *in vivo* and that the genotoxicity of steviol and some of its oxidative derivatives *in vitro* is not expressed *in vivo*," (Abudula et al., 2004).The report also found no evidence of carcinogenic activity. Furthermore, the report noted "Stevioside has shown some evidence of pharmacological effects in patients with hypertension or with diabetes mellitus type 2 ", but concluded that more studies were required to determine proper dosage. The WHO's Joint Experts Committee on Food Additives has approved, based on long-term studies, an acceptable daily intake of steviol glycoside of up to 4 milligrams per kilogram of body weight, (Benford et al, 2009)

3.0 An overview on Sugar

Sugar technically known as sucrose was introduced to the market in India as far as a few thousand BC.Since olden days' people have always had a predisposition to consume sweetened products or beverages and this has been accomplished by putting sugar from sugar cane in most products (Schmitz et al., 2002).

Most of sugar/sucrose is made from either sugarcane or sugar beet. It is normally white in color or brown if it is has not passed the bleaching process. It is used in pharmaceutical applications to mask the bitter taste of medicine, or in food to heighten their taste even in beverages to make them more pleasant to consume. (Woloson,2002)

However, sweeteners are fast replacing sugar as a sweetener because of dental cariers and other problems associated with it. Mitchell (2006) wrote that sweeteners and sugar alternatives

may have some important physiological effects and subsequent health benefits such as improved glycaemic control, dental health, digestive health and calorie reduction.

4.0 Sensory Evaluation

4.1Flavor

Flavor is defined differently according to the context or the source. The United States Food and Drug Administration states that flavoring agents are "substances added to impart a taste or aroma in food".This is a broad definition which includes thermally processed flavors,natural flavors and even nature-identical flavors.(Burdock,2002)

4.2 Flavor and sweeteners

A few tests have been done to find out the interaction of different flavors and sweeteners.(Schiffman et al,1985) did research that suggest that drinks containing sucrose and aspartame cannot be discriminated from one another in either a lemon-line or cola medium in this experimental design. Sucrose and aspartame were also statistically equivalent on every adjective scale for both lemon-line and cola drinks. On both similarity judgments and adjective scales, acesulfam-K and sodium saccharin were most different from sucrose. The calcium cyclamate/sodium saccharin blends tended to be less similar than aspartame but not as different from sucrose as the acesulfam-K or sodium saccharin sweetened beverages, (Schiffman et al, 1985).

4.3 Aftertaste

Neely and Borg (1999) described aftertaste as the taste intensity of a food or beverage that is perceived immediately after that food or beverage is removed from the mouth. The aftertastes of different foods and beverages can vary by intensity and over time, but the unifying feature of aftertaste is that it is perceived after a food or beverage is either swallowed or spat out.
The neurobiological mechanisms of taste (and aftertaste) signal transduction from the taste receptors in the mouth to the brain have not been elucidated completely. Recently, the primary

taste processing area located in the insula has been observed to be involved in aftertaste perception, (James et al, 2009).

4.4 Aftertaste in sweeteners

Although sweeteners have been found out to have more health benefits than sugar, most of them have an unpleasant aftertaste.This health factor can impact consumer decision to purchase them instead of sugar. (Goyal et al. 2010)

4.5 Stevia aftertaste

Some people experience a bitter aftertaste when consuming products with Stevia sweetener in them. This bitter taste is due to the presence of essential oils, tannins and flavonoids which are similar to the compounds that make tea and coffee bitter, but give them their therapeutic potentials. Stevioside and rebaudioside A (or Reb A) are partially responsible for the aftertaste, with Reb A contributing less than stevioside. Reb A is usually the Stevia extract you will find on store shelves. (Goyal et al. 2010)

Due to this bitter taste, many Stevia leaf products on the market today also contain other lower-calorie sweeteners (like erythritol and maltodextrin) to cut out some of this not-so-pleasant taste. These added agents also prevent caking of Stevia, because alone it tends to be very water-loving and will clump. Stevia in its raw form, although incredibly sweet, has a very subtle liquorice essence to it. A sign of an excellent Stevia product is one that is free of this liquorice essence and still not bitter. (http://www.herb-care.com/stevia-no-aftertaste.html)

5.0 Consumer Perception and Acceptance

The way consumers perceive the food in terms of quality or taste is a very important aspect in food technology. This perception is influenced by many things including culture, background and nutritional content. However, generally all human beings are born with the need to refrain from eating anything bitter or unpleasant due to caveman times to stop themselves from ingesting poison. A study by Jaeger and colleagues (1998) found no differences in consumer

perception of apples based on cultural differences. So if the apple tastes sweet, most consumers regardless of their background will choose it over one that taste "mealy".

However these days consumer acceptance is influenced by health information and risk evaluation. Many consumers are willing to eat something that does not have a good taste if they believe it will give them health benefits. Not a lot of research has been done about acceptance of stevia astringent aftertaste however many journals are available on acceptance of unpleasant taste and health information availability. For example, Frewer and his colleagues (1997) realized that the psychological impact of information provision about food health risks depends mainly on consumer trust in the information source, perception of hazard characteristics, informational content and presentation format .Whereas food risk perception in the strict sense is well-documented, little is known about the balance of safety risks and health benefits in consumers' food choice (Alhakami and Slovic, 1994). Studies on communication effectiveness and information processing have shown that adverse messages or negative press related to food health issues can heavily influence consumers' food consumption decisions (Carson and Hassel, 1994)

6.0 Food Neophobia

6.1 Definition

Food neophobia is a naturally occurring reaction in humans that protect individuals from the risk of being poisoned by consuming potentially harmful foods. It accounts for a person's reluctance to consume either new or unusual foods, based on one's culture and current diet (Stallberg-White&Pliner, 1999)

6.2 Measurement and Scale

Food neophobia is measured on a scale called the food neophobia scale or FNS that was developed in the early 1990s.It is basically a questionnaire with 10 items, 5 of which are positive statements and the other 5 are negatively worded. For analyzing the data, a 7-point scale that has 1 as strongly disagree and 7 as strongly agree is used. The 5 positively worded statements have

to be reversed first to get the correct number so that in the end a higher number means greater food neophobia. (Pliner and Hobden, 1992).

6.3 Factors influencing Food Neophobia

Pliner and her colleagues found out that the reason people are hesitant to taste new foods is that there is a wide spread belief that novel foods might be less tasty than familiar ones. (Pliner, Pelchat, &Grabski, 1993) In the same study, the results indicated that after being exposed to foods that were unfamiliar before then the next time the individuals will not be neophobic towards the food but this is only for adults not children.(Pliner et al,1993) also makes the distinction between food neophobia in a particular situation and food neophobia as a personality trait. Situational neophobia is affected by information both direct and indirect on taste and benefits while food neophobia as a trait is something within an individual that prevents them from being willing to try new food. However more studies are needed on the case of food neophobia. Studies by (Henriques et al, 2008) indicate that extreme neophobics do not typically volunteer for product development tests. Their results on investigating relationship between neophobia and product development found no extreme neophobics. Apparently neophobics are not exclusively recruited; it is likely they will not be well characterized in the respondent base of a consumer test. Nevertheless, the majority of participants in most consumer studies testing novel food items are probably not neophobic.

7.0 Food Involvement

7.1Definition

Food involvement refers to how much an individual is engaged with food and this influences brand loyalty, purchasing and view of food as nutritional objects not only as mere culinary objects. Olsen (2001) presented a theoretical model of involvement based on expectancy-value theory, and incorporated into the model negative feelings, social norms and moral obligations.

7.2 Measurement and scale

The scale was made looking at food involvement directly basing on information by Goody (1982), an anthropologist who studied culinary differences between tribes in Africa, conceptualized the life cycle of food in terms of distribution, preparation and consumption, and described the following five stages as comprising this cycle: acquisition, preparation, cooking, eating, and disposal. For the actual measuring of data participants rated their level of agreement with each of the items on a 7-point scale with labeled endpoints (disagree strongly, agree strongly). Items were also rated for face validity on a 7-point scale with labeled endpoints (extremely low, extremely high) by an experimenter and two psychologists uninvolved with the research. (Bell and Marshall, 2003).Half of the statements were stated positively; the remaining statements were stated negatively. Therefore, for analysis, scoring on the scales for the negatively stated items was reversed. Total scores, arrived at by adding the ratings for each item, and mean face validity ratings were calculated. Then validity of the scale was analyzed with SPSS program at 95%confidence interval. (Bell and Marshall, 2003)

Table 1: Food involvement scale

Food involvement scale
1. I do not think much about food each day.
2. Cooking or barbequing is not much fun.
3. Talking about what I ate or am going to eat is something I like to do.
4. Compared with other daily decisions, my food choices are not very important.
5. When I travel, one of the things I anticipate most is eating the food there.
6. I do most or all of the clean up after eating.
7. I enjoy cooking for others and myself.
8. When I eat out, I don't think or talk much about how the food tastes.
9. I do not like to mix or chop food.
10. I do most or all of my own food shopping.
11. I do not wash dishes or clean the table.
12. I care whether or not a table is nicely set.

Source: Bell and Marshall (2003)

7.3 Studies and research

In 2003, Bell and Marshall wrote that in a lot of customer behavior studies, level of involvement is assigned either as a personality characteristic of the individual toward a product or to the product categories themselves and often relates to the time investment involved in the choice decision, and includes the social risk of using or not using a product, and the financial risk relative to one's ability to pay for the product. In that context, a product that is believed to be a low-involvement choice is one for which the individual does not consider the choice decision to be important enough to his or her belief system to warrant extensive effort in the decision making process. For instance, a product is labeled as being of 'low involvement' if the process to search for information about it is minimal, if there are no distinct brand loyalties for the product, and if a lower price for a competing brand leads to a choice decision based solely on cost e.g., copy paper, paper clips, light bulbs). On the other hand, a 'high-involvement' product is one for which the consumer invests substantial time and effort prior to making a choice decision e.g., automobiles, homes, vacations. (Bell and Marshall, 2003) The sensation and pleasure associated with the eating experience assume more importance for an individual who is high in food involvement than for one who is low. However, also the idea that a person who has had extremely negative experiences with food likes allergies/intolerance cannot be discounted. They might also place a high importance on food not for its pleasure but because greater diligence would lead to a lower likelihood of a future negative food intake event. It is then not difficult to imagine that more highly food-involved individuals might pay more attention to foods themselves during all phases of interaction with them, possibly including their procurement, preparation and cooking. If this argument is taken further, this increased attention might lead to a greater ability to differentiate between products from a purely sensory perspective. (Bell and Marshall, 2003)

8. Health and Taste Attitude Scales

8.1Definition

The health and taste attitude scale (HTAS) developed by Roininen and published in 2001 determines the importance of health and taste characteristics of foods in the food choice

process. (Roininen, 2001) These multi-item scales is made of sets of statements, ranging from "strongly disagree" to "strongly agree", which further divide into
three Health (General health interest, Light product interest and Natural product interest) and three Taste (Craving for sweet foods, Using food as a reward and Pleasure) sub-scales.

Table 2:Health sub-scale

GENERAL HEALTH INTEREST	LIGHT PRODUCT INTEREST	NATURAL PRODUCT INTEREST
1. I am very particular about the healthiness of food. 2. I always follow a healthy and balanced diet. 3. It is important to me that my diet is low in fat. 4. It is important to me that my daily diet contains a lot of vitamin and mineral. 5. I eat what I like and I do not worry about the healthiness of food. (R) 6. The healthiness of food has little impact on my food choices. (R) 7. The healthiness of snacks makes no difference to me(R) 8. I do not avoid any foods, even if they may raise my cholesterol. (R)	I believe that eating light products keep one's cholesterol level under control I believe that eating light products keeps one's body in good shape. In my opinion by eating light products one can eat more without getting too much calories. In my opinion, the use of light products does not improve one's health. (R) In my opinion light products don't help to drop cholesterol levels. (R) I do not think that light products are healthier than conventional product. (R)	I do not eat processed foods, because I do not know what they contain. I try to eat foods that do not contain additives. I would like to eat only organically grown vegetables. In my opinion, artificially flavored foods are not harmful to my health. (R) In my opinion, organically grown foods are no better for my health than those grown conventionally. (R) I do not care about additives in my daily diet. (R)

Source: Roininen (2001)

Table 3:Taste sub-scale

CRAVING FOR SWEET FOODS	USING FOOD AS A REWARD	PLEASURE
1. I often have cravings for sweets 2. I often have cravings for chocolate 3. I often have cravings for ice cream 4. In my opinion it is strange that some people have cravings for sweets. (R) 5. In my opinion it is strange that some people have cravings for chocolate.(R) 6. In my opinion it is strange that some people have cravings for ice cream.(R)	I reward myself by buying something really tasty I indulge myself by buying something really delicious I avoid rewarding myself with food.(R) In my opinion comforting one-self by eating is self deception. (R) I try to avoid eating delicious food when I am feeling down.(R)	The appearance of food makes no difference to me.(R) When I eat I concentrate on enjoying the taste of food I do not believe that food should be a source of pleasure. (R) It is important for me to eat delicious food on weekdays as well as weekends An essential part of my weekend is eating delicious food I finish my meal even when I do not like the taste of food. (R)

Source: Roininen (2001)

8.2 Attitudes

Attitude was defined as the way a person react towards a certain stimuli, such as food whether favorably or unfavorable.(Eagly & Chaiken,1993).According to Sims(1981),who studied nutrition related attitudes, the difference between belief and attitude is that the former is more cognitive related whereas attitude is more affective. Therefore when evaluations are more about the individual's feelings and less about right and wrong or reasoning then the factor at play is attitude. (Sims 1981).To measure attitudes, their existence can be assumed from responses or indicators as it is not possible to observe them directly. (Eagly & Chaiken, 1993).This is commonly done by the use of Likert scales whereby many of the values are summed up and their average calculated for the most precise results. Likert scales rely on a person's affective response towards a specific attitude object. Thus, the investigator must employ a different scale, consisting of different items for each attitude object (Sims, 1981).

8.3 Health Attitudes

In the last 10 years, a lot of research has been conducted to try and reduce the gap between actual diet and dietary recommendation. However obesity and other nutritional diseases are still rampant so many people have published studies trying to get an understanding of why this gap still exists. (Wardle & Steptoe, 1991; Wardle et al., 1992; Rozin et al., 1999).Many people state that health is an important factor in food choice yet studies show that many people are still purchasing and eating unhealthy food. . However, it is well known that health is not the only factor affecting food choice, nor is it the only important factor affecting food choice. However, the discrepancy between dietary recommendations and actual food consumption, and the influence of health on food choice, make health-related attitudes a very interesting subject to study. (Roininen 2001). The knowledge of different health behaviors does not have an effect on behavior if a person is not motivated to change (Moorman & Matulich, 1993). According to Steptoe & Wardle (1991), respondents who were made aware of their low health status tried to eat healthily. Furthermore, dietary fat avoidance was associated with awareness of health risks

and beliefs about the importance of controlling fat intake. A Pan-European survey respondents who believed that good health is a result of healthy eating ranked a low-fat diet (48%) the highest, followed by a balanced diet (43%), the intention to eat more fruit and vegetables (41%) and to the consumption of fresh, natural food (28%) as part a healthy diet (Zunft et al.,1997) .

8.4 Taste Attitudes

Other than health, taste is also one of the factors that influence food choice. In Sweden taste was rated as the most important factor according to respondents for food choices (Koivisto & Sjödén, 1996), the most important attitude factor in the consumption of fruits and vegetables in the Netherlands (Brug et al., 1995) and (Holm & Kildevang, 1996) found it to be an important criterion for buying food in Denmark. So in general, it is clear that all over the world, taste is a very important factor in food choice. Nevertheless, it seems like nutritional information may override pleasure and taste as the most important factor in food purchasing and consumption. McFarlane & Pliner (1997) found that Canadian high school and college-age subjects who were concerned with general nutrition were not interested in the positive taste information provided on the novel foods. The authors suggest that these subjects have adopted a concern for health and are willing to sacrifice taste for healthy food consumption.

8.5 Relevance and Validity of HTAS Scale

Scales that purely concentrate on measuring health-, taste-, and sensory-related attitudes in the food choice process have not been available. There has however, been a need for scales that can be used, for example, in monitoring long term nutrition-related attitudes or for consumer segmentation in product development. As health and taste have been confirmed as factors influencing food choice it has been important to develop a scale for them. These Health and Taste Attitude Scales (HTAS) were developed and validated to meet this need. (Roininen, 2001)The predictiveness and cross national validity of the scale was shown in Finland, Britain and Netherlands. The studies showed that it was a good tool for classifying attitudes among customers. (Roininen, 2001)

9.0 Likert Scales

Likert (1932) developed the principle of measuring attitudes by asking people to respond to a series of statements about a topic, in terms of the extent to which they agree with them, and so tapping into the cognitive and affective components of attitudes. Likert (1932) proposed a summated scale for the assessment of survey respondents' attitudes. Individual items in Likert's sample scale had five response alternatives: Strongly approve, Approve, Undecided, Disapprove, and strongly disapprove. Likert noted that descriptors could be anything – it is not necessary to have negative and positive responses. He implies that the number of alternatives is also open to manipulation. Likert's original work assumed an attitude scale would first be pilot tested for reliability assessment of the individual items. This reliability assessment might use the correlation between the item score and the total or use a split-half procedure. In any event, the items not correlated with the total would be discarded. Subsequent data would be summarized using the totals. A Likert-type scale assumes that the strength/intensity of experience is linear, i.e. on a continuum from strongly agree to strongly disagree, and makes the assumption that attitudes can be measured. Respondents may be offered a choice of five to seven or even nine pre-coded responses with the neutral point being neither agree nor disagree. McLeod, S. A. (2008).

MATERIALS AND METHODS

Materials and Equipment

- Stevioside (Wang Chemical Company Ltd.)
- Sugar
- Water
- Flavors-lime, orange, strawberry and orange (Givaudan (Thailand) Ltd.
- SAS version 9.2 program(SAS institute inc,USA-licensed to Assumption University, Thailand)
- Disposable cups
- Dropper
- Electronic scale

Methodology

1. Formulating sweeteners ratio

100g of sugar was added to 1000ml of water then stirred. Then to a different container Stevioside was added as 0.4g to 1000ml of water, this was sweetness ratio of 1:250 sugar, Stevia. A third formula of 0.5g Stevia to 1000mlwater was also prepared with sweetness ratio of sugar to Stevia assumed as 1:200.The samples of about 20ml each were given to 42 consumers to taste and each consumer had to taste all 3 samples at once then evaluate the sweetness intensity. The data was collected by filling out a questionnaire and all the samples were served using chilled water because normally beverages are consumed when they are cold. The consumers did not know the formulation of the sweeteners or of the flavors to prevent bias and the cups were given 3 digit codes randomly

2. Formulating flavored beverages

0.5ml of orange flavor was added to 1l of water, drop by drop then tasting until a discernible taste was present. Then this was taken as the standard formula for orange and a sensory tasting

was done with 3 formulations at 0.025% ,0.050% and 0.075 of the flavor. The experiment was duplicated with the first duplication containing sugar as a sweetener and the other sweetened with Stevioside.

A random group of 30 consumers were chosen to taste and evaluate the beverages using hedonic scale and sensory intensity questionnaire. Each consumer tasted 6 samples in total and got a set of 3 cups at a time being either Stevia first or sugar first and having 3 different levels of flavor. A cup of water was also provided for mouth rinsing to prevent flavor carry over in the samples. The results were then analyzed with SAS 9.2 program

The above procedures were repeated with strawberry, lime and green tea flavor.

3. Consumer perception on Aftertaste

Beverages were prepared according to the preferred formulas from consumers as seen from the results of SAS analysis, in regards to sugar, Stevia and flavor ratio.There were 120 consumers randomly chosen to taste the different beverages and also fill out a questionnaire that included demographics, health and lifestyle and beverage preference. There was also a hedonic rating and questions especially on aftertaste perception. Each consumer was given 8 samples, presented 4 at a time. Each set was sweetened with sugar or Stevia and 1 cup contained 1 flavor. This order was randomized, some people got Stevia first while some got sugar first and also randomized design was employed so that each flavor was tasted at the beginning, as second, third or at the end each time for fairness of results. The randomization method used is the Williams square design. The consumers were unaware of the formulations but were asked about allergies beforehand and the cups had 3 random digit codes to prevent bias.

The results were analyzed statistically using SAS 9.2 program

RESULTS AND DISCUSSION

1. Formulation of Sweeteners

Table 4: Output for sweetener intensity

t Grouping	Mean	N	treatment
A	7.5	42	A
B	6.0	42	B
B	5.9	42	C

NOTE: Mean values within the same character note with a different letter are significantly different.

In this part of the experiment, 3 samples were given to consumers to analyze being sugar, Stevia at 250times intensity and Stevia at 200 times intensity. The results showed a significant difference meaning that consumers could detect that sugar and Stevia had a different level of sweetness. Sugar had a mean of (7.6), Stevia at 250times had a mean of (6.1) and Stevia at 200 times has a mean of (5.9).Moreover the results show that consumers rated sugar sweetness closest to the sweetness of Stevia at 250 times so this can be accepted as the ratio needed for the experiment. In essence consumers could detect that sugar and Stevia were different-however Stevia at 250 times was closer to taste of sugar than Stevia at 200 times.

2. Formulating flavored beverages

Table 5: Output for Orange Overall Liking

Flavor concentration	Means difference	Simultaneous 95% CL
1 - 2	0.02	(-0.8 0.8)
1 - 3	0.3	(-0.5 1.1)
2 - 1	-0.02	(-0.8 0.8)
2 - 3	0.3	(-0.5 1.1)
3 - 1	-0.3	(1.1 0.5)
3 - 2	-0.3	(-1.1 0.5)

Comparisons significant at the 0.05 level are indicated by ***

No significant differences were observed for overall liking between the 3 flavor concentrations; 1 being 0.025%, 2 was 0.050% and 3 was 0.075%.Therefore the lowest concentration being 0.025% was used in order to save costs.

Table 6: Output for strawberry Overall Liking

Flavor Concentration	Difference Between Means	Simultaneous 95% CL
3-2	0.07	(-0.5 0.7)
3-1	0.1	(-0.5 0.7)
2-3	-0.07	(-0.7 0.5)
2-1	0.03	(-0.6 0.6)
1-3	-0.1	(-0.7 0.5)
1-2	-0.03	(-0.6 0.6)

Comparisons significant at the 0.05 level are indicated by ***

No significant differences were observed for overall liking between the 3 flavor concentrations; 1 being 0.025%, 2 was 0.050% and 3 was 0.075%.Therefore the lowest concentration being 0.025% was used in order to save costs.

Table 7: Output for Lemon Overall Liking

Flavor concentration	Diff between means	Simultaneous 95%CL
1 – 2	0.02	(-0.7 0.7)
1 – 3	0.4	(-0.3 1.0)
2 - 1	-0.02	(-0.7 0.7)
2 - 3	0.3	(-0.4 1.0)
3 - 1	-0.4	(-1. 0.4)
3 - 2	-0.3	(-1.0 0.4)

Comparisons significant at the 0.05 level are indicated by ***

No significant differences were observed for overall liking between the 3 flavor concentrations; 1 being 0.025%, 2 was 0.050% and 3 was 0.075%.Therefore the lowest concentration being 0.025% was used in order to save costs

Table 8: Output for Green tea Overall Liking

Flavor concentration	Means	95% Confidence Limits
1 – 2	0.02	(-0.7 0.7)
1 - 3	0.4	(-0.3 1.0)
2 - 1	-0.02	(-0.7 0.7)
2 – 3	0.3	(-0.4 1.0)
3 – 1	-0.4	(-1.0 0.3)
3 – 2	-0.3	(-1.0 0.4)

Comparisons significant at the 0.05 level are indicated by ***

No significant differences were observed for overall liking between the 3 flavor concentrations; 1 being 0.25in 1L of water, 2 was 0.50ml and 3 was 0.75ml.Therefore the lowest concentration being 0.25ml/1L was used in order to save costs.

3. Consumer perception on Aftertaste

Table 9: Output for analysis of treatments

	TREATMENT MEANS ± SD							
RIBU	STV lemon	SUG lemon	STV green	SUG green	STV Orange	SUG Orange	STV Straw	SUG Straw
etne	6.6±0.4^{ab}	9.1 ±0.4^{def}	6.9 ±0.4^{abc}	8.5±0.4^{cde}	7.2 ±0.4^{abc}	8.8 ±0.4^{def}	7.6 ±0.4^{bc}	9.6±0.4^{ef}
rtas	6.0 ±0.4^{abcde}	5.3±0.4^{ade}	6.5 ±0.4^{acd}	6.0 ± 0.4^{abcde}	5.6 ±0.4^{abcde}	4.9±0.4^{ae}	6.2 ±0.4 abcd	5.7 ±0.4^{abcde}
er	0.7±0.0^{b}	0.2±0.0^{a}	0.5±0.0^{b}	0.2±0.0^{a}	0.5±0.0^{b}	0.2±0.0^{a}	0.3±0.0^{b}	0.2±0.0^{a}
inge	0.5±0.0^{b}	0.3 ±0.05^{a}	0.6±0.0^{b}	0.3±0.0^{a}	0.6±0.0^{b}	0.3±0.0^{a}	0.6±0.0^{b}	0.3 ±0.0^{a}
	5.0 ±0.2^{bcd}	5.6 ±0.2^{def}	4.5±0.2^{ab}	4.4±0.2^{ab}	4.3±0.2^{ab}	4.8±0.2^{ab}	5.2 ±0.2^{bcde}	6.0±0.2^{ef}

NOTE: Mean values within the same character note with a different letter are significantly different

For this part of the experiment all calculations were made at ($p<0.05$).A significant difference was noted in sweetness intensity for the 8 treatments. Stevia sweetened treatments for lemon, green tea and orange were the least sweet followed by Stevia sweetened treatments for strawberry and green teas with sugar. Sugar treatments were perceived to be sweeter across all flavors with strawberry being the sweetest(9.6).Although Stevia is known to be sweeter than sugar it has an astringent aftertaste and this can cause consumers to feel it's not as sweet in beverages as sugar due to the astringency interfering with the tasting perception.

For aftertaste intensity, no significant difference was observed for all treatments, ($p<0.05$). Stevia sweetened lemon and Stevia sweetened orange as well as sugar sweetened green tea and sugar sweetened strawberry were perceived by consumers to be similar in taste. All the other treatments were apparently similar in aftertaste to the consumers.

The bitterness of the treatments was significantly different distinctly according to sweetener, ($p<0.05$). Bitterness was scored on a present/absent basis with 1 being the highest number attainable and indicating presence of bitter taste. Stevia sweetened beverages were bitter than sugar sweetened ones with the highest mean being that of Stevia lemon (0.7) and the lowest being of sugar strawberry (0.2)

Astringency was also significantly different in the treatments. Like bitterness the values represent absence or presence of astringency detected. A score of 1 means presence of astringent taste and 0 indicates absence. The division came from the sweeteners with Stevia sweetened beverages being very astringent within similar groups while sugar sweetened beverages were less astringent. Calculations were carried out at ($p<0.05$). The highest recorded astringency was (0.5) for Stevia green tea with the lowest being (0.3) for both sugar green tea and sugar lemon. However the between astringency was only (0.2) unlike bitterness (0.5).This is because astringency is a fairly uncommon term and the translation in Thai is also not so clear so consumers could not relate to it so much. On the other hand everyone knows the definition of bitterness and as such was more comfortable to put down bitterness as the aftertaste detected as compared to astringency.

A significant difference was observed for overall liking, ($p<0.05$). The highest overall liking was strawberry sugar (6.0) from a 9-point hedonic scale. This is not a surprise because

strawberry flavored beverages are normally sweet. The strawberry fruit itself is sweet and when consumers think of the fruit being used as a flavor they expect it to be sweet and thus they like the sugar sweetened strawberry beverage more than the Stevia sweetened one (5.2) because of the astringency and bitterness associated with Stevia. The least liked beverage was Stevia orange(4.3).Although orange can sometimes be sour, consumers due to commercialization of orange juice as being a sweet drink, are more likely to like sugar sweetened orange beverage.

Table 10: Output for analysis of flavor

Flavor / Note	Sweetness intensity	Aftertaste	Bitterness	Astringency	Overall like
Green	7.7±0.3^{a}	6.3±0.3^{ac}	0.33±0.0^{b}	0.40±0.0	4.4±0.1 ^{a}
Lemon	7.8±0.3^{a}	5.7±0.3 ^{abc}	0.34±0.0^{b}	0.45±0.0	5.3±0.1^{b}
Orange	8.0±0.3^{ab}	5.3±0.3 ^{ab}	0.33±0.0^{b}	0.46±0.0	4.6 ±0.1 ^{a}
Strawberry	8.6±0.3^{b}	5.9±0.3 ^{abc}	0.24±0.0^{a}	0.46±0.0	5.6±0.1^{b}

NOTE: Mean values within the same character note with a different letter are significantly different.

When taking out the influence of sweetener and analyzing only flavors, the highest sweetness intensity score was that of strawberry (8.6) out of a total 15.Strawberry flavor is described as having a sweet smell and a sweet taste thus it is no surprise that it is rated to be the highest in sweetness. Green tea had the lowest score at (7.7) which is also expected due to the fact that green in its natural state is not sweet tasting but can be bitter. For the further analysis, strawberry and orange were not significantly different, ($p<0.05$) while orange was also still in the same grouping as lemon and green tea.

Aftertaste intensity was not significantly different for all the flavors, ($p<0.05$). Green tea had the highest score for aftertaste (6.3).Orange, lemon and strawberry were in the same category for aftertaste with orange being ranked the least for aftertaste at (5.3) from an overall of 15.Consumers tend to regard the meaning of aftertaste as an unpleasant taste like astringency or sourness so they gave green tea the highest score because the flavor itself has a leafy aftertaste in the mouth.

For bitterness only strawberry was significantly different from the other 3 at ($p<0.05$) with a low score of (0.2) from a total of 1.Lemon, green tea and orange were not different in bitterness according to consumers. Apparently this 3 were bitter and only strawberry did not have a bitter taste.

Astringency was not significantly different across flavors, ($p<0.05$). The 4 flavors were regarded to be of the same astringency by consumers

Overall liking was significantly different between the flavors, ($p<0.05$). Strawberry and lemon appear to be liked most while orange and green tea was not liked so much by the consumers. As the consumers gave strawberry the highest score for sweetness intensity, it is expected that they like it most as humans are predisposed to consume sweet food or beverages. Surprisingly lemon is liked the same as strawberry yet it ranked highest in terms of bitterness. The logical explanation could be that when people consume lemon beverages they anticipate a sour taste and so they associate bitterness with the real taste of lemon. Therefore they are more likely to favor bitter lemon as it is akin to the natural taste of lemon.

Table 11: Output for sweetener analysis

Sweetener/Note	Sweetness intensity	Aftertaste	Bitter	Astringent	OL
Stevia	7.0 ± 0.2^{a}	6.0 ± 0.2^{a}	0.4 ± 0.0^{a}	0.5 ± 0.0^{a}	4.7 ± 0.1^{a}
Sugar	9.0 ± 0.2^{b}	5.5 ± 0.2^{b}	0.2 ± 0.0^{b}	0.3 ± 0.0^{b}	5.1 ± 0.0^{b}

NOTE: Mean values within the same character note with a different letter are significantly different.

Analyzing sweetener proved that the results were highly because of the sweetener used. For all character notes, there was a significant difference between sugar and Stevia, ($p<0.05$). As expected, sugar ranked higher for sweetness intensity (9.0) from a 15point scale and overall liking (5.1) from a 9-point hedonic scale. Sweetness intensity results in overall liking because people in general prefer consuming sweet things. Stevia had the highest scores for aftertaste (6.0) from a 15 point scale which is also not a surprise as Stevia is known to have an unpleasant

aftertaste. Stevia also ranked highest in terms of bitterness and astringency as per expectations. For bitterness and astringency which were judged on a present/absent basis their means were (0.4) and (0.5) respectively.

Table 12: Output for analysis of FIS and FNS

Gender	FIS	FNS
F	54.9±6.6	36.7±7.6
M	54.3±8.0	37.2±7.2

NOTE: Mean values within the same character note with a different letter are significantly different.

Gender did not have a significant effect on food involvement and neophobia. The majority of the consumers were between the ages of 18-24 and mostly college students. Therefore, their gender has no effect on food involvement or neophobia because mostly their thoughts are similar at this point. For food involvement, both female and male subjects have a relatively high score; therefore they are involved with their foods and as such can detect differences in food samples. However for food neophobia the scores were not as high. Using the extreme scaling detailed by Pliner, P. & Hobden, K. (1992) where neophilics were defined as those scoring <25 and neophobics as >35 both males and females in this study were neophobic. However this is to be expected as all humans have an innate fear to be hesitant to try new food or beverages.

Table 13: Analysis of HTAS individual scales

Gender	Health	Natural	Light	Craving	Reward	Pleasure
F	4.2±0.9	4.1±0.6	4.1±0.8[a]	4.3±1.0	4.5±0.8	4.4±0.7
M	4.2±0.9	4.2±0.6	4.4±0.8[b]	4.5±1.0	4.7±0.8	4.6±0.8

NOTE: Mean values within the same character note with a different letter are significantly different.

Health attitudes ranging from general health to liking of natural products were not significantly different. The consumers being investigated were mostly university students and

their mindsets are not really different at this point. Moreover, health foods are more expensive than "normal" food and therefore most people cannot afford it on a student's budget. The scores were all around (4.1) from a 7-point hedonic scale, therefore it is evident that the consumers investigated did not worry a lot about their health or eating healthier products. However, light products attitude were significantly different. Males had more inclination to consume light products (4.4) than females (4.1).This difference is not big but it could be due to that many college going males are now more conscious of what they eat than their female counterparts. As for taste attitudes there was also no significant difference between the genders. Their cravings or indulgence into food for reward or pleasure were similar. The scores were also not high, with the highest being only (4.7) from a 7-point hedonic scale for reward scale concerning males. It's no surprise that taste attitude was not really high amongst consumers as during college years most people are too busy with examinations and coursework that eating is normally only to fulfill the primary role of banishing hunger.

Table 14: Output for general HTAS scale and subscales

Gender	HTAS	Health	taste
F	4.3 ± 0.3^{a}	4.3 ± 0.5	4.4 ± 0.5^{a}
M	4.4 ± 0.4^{b}	4.5 ± 0.5	4.6 ± 0.7^{b}

NOTE: Mean values within the same character note with a different letter are significantly different.

For the combined results, while analyzing both taste and health sub-scales there was a significant difference between males and females with males having a higher score than females. So for general attitude it appears as males (4.4 from 7-point hedonic scale) care more than females (4.3) about what they eat. For the health sub scale, there was no significant difference between the genders while taste subscales had a significant difference between .Males have an inclination to eat food more for taste than females. This can be explained by the growing trend that males love eating food for taste such as pizzas while females don't mind eating bland salads due to societal influence or pressure to eat more 'feminine'.

4. Demographics

For gender, there were almost as many females as males. It was a total of 120 consumers, 69 of which were female and the rest were males. Therefore, gender did not greatly influence results that much.

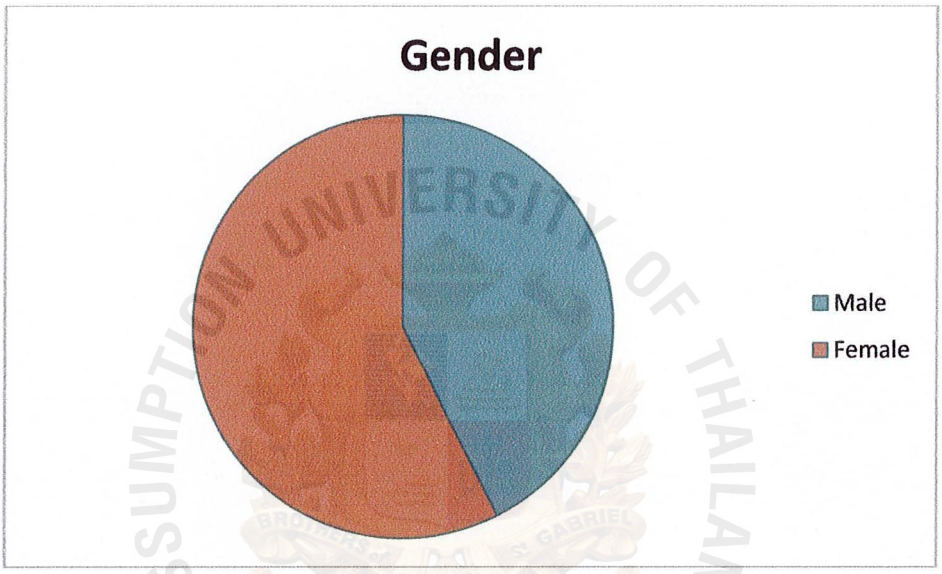

Figure 2: Gender of consumers

For the age distribution, the majority of consumers were found around Assumption University mainly in the age range of 18-25 years. So most of them are still young and this affects results like the health and taste attitude because as Pliner stated, the older a person the more they care about their health. However youth do not really mind so much about the healthiness of their food because many times coronary heart disease or high cholesterol is associated with old age. No one was less than 18years in this survey so everyone was an adult.

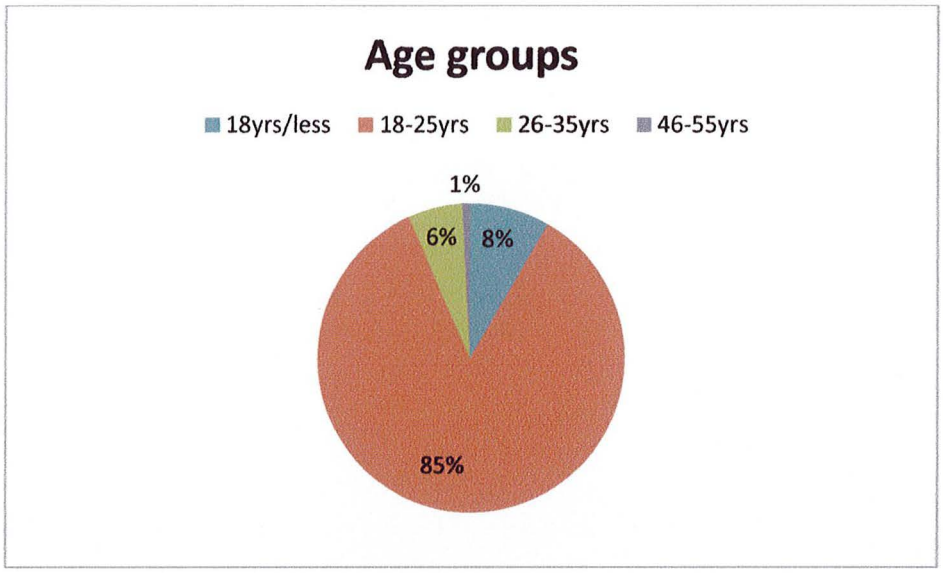

Figure 3: Age group of consumers

Education wise most of the consumers had a Bachelors degree because I recruited the volunteers for the tasting around Assumption University of Thailand. Most of them are still students and a few had part time jobs. Biotechnology and Science and Technology faculty was the most abundant as they were easier to recruit and more willing to spare their time than others. Moreover the preparation area for the beverages is nearer to the common area of this 2 faculties hangout.

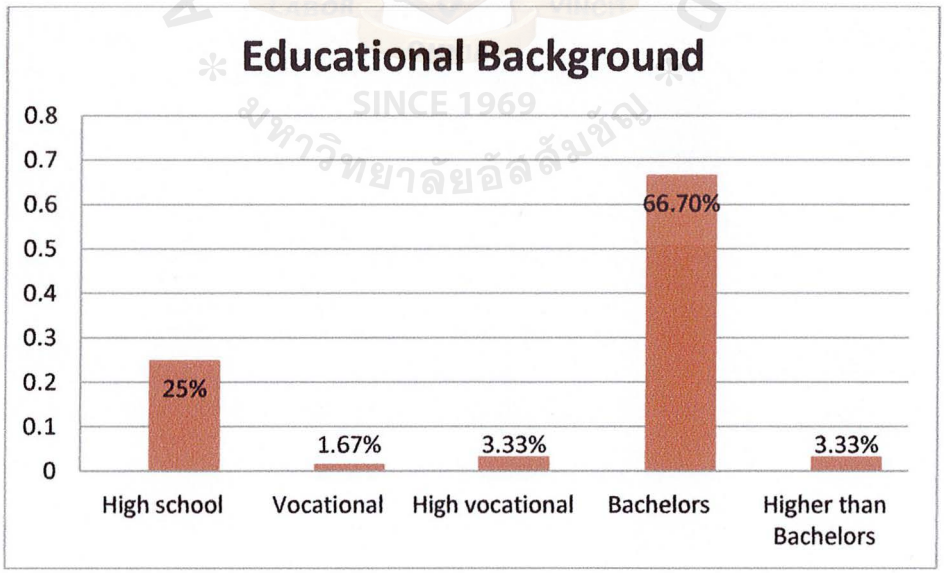

Figure 4: Educational background of consumers

Finally on the issue of income which is related to purchase decision most of the consumers did not earn much per month. This could explain why they did not have health or taste related attitudes as the most important thing for them is lowest price. Moreover people who eat have least income might be less involved with food as they don't spend a lot of time deciding, the price is the determinant. It also clarifies the food neophobia they experience as if they always eat the cheapest food then they will be less willing to try new foods since they have established a particular routine.

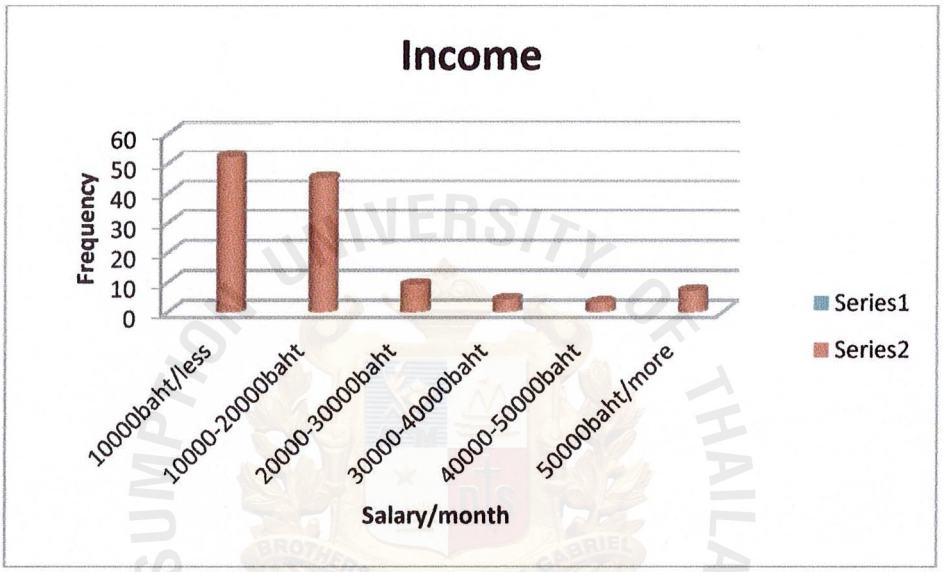

Figure 5: Income of consumers

Perhaps something noteworthy which is not evident in the results analysis but from the raw data is that consumers who tasted Stevia first were more likely to give sugar sweetened beverages a much lower score than those who tasted sugar sweetened beverages first. This is because Stevia has a lingering aftertaste. Moreover consumers who tasted Stevia were more likely to give sugar sweetened beverages a mark for bitterness and/or astringency. This could be that the aftertaste of Stevia is detected after a while so then it interferes with the tasting of the subsequent beverages. Plus the consumers progressively gave lower marks for Stevia sweetened beverages. This means if one tasted any flavor first they rated it higher than the following ones. Therefore in this aspect, randomizing the order of the beverages helped to ensure a fair experiment. More research is still needed for example by experimenting with a trained panel to

make sure that their vocabulary for the sensory experience is the same and they could be more descriptive writing to describe their own feelings about the taste.

CONCLUSION

Different flavored beverages have been successfully formulated with sugar and Stevia used as sweeteners. There was a significant difference in the character notes investigated ($p<0.05$) except aftertaste .Strawberry with sugar was liked most, lemon with Stevia recorded the highest bitterness and Green tea with Stevia was the most astringent. No significant differences between male or female involvement and neophobia were noted. As for the health and taste attitude subscales, the individual scales had no significant differences except for light product interest, with males having a higher mean than females. Furthermore, on the general scale, males had a higher mean as well as on the taste subscales. More research is still needed and ways to eliminate the lingering aftertaste of Stevia should be investigated.

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APPENDIX I:

SAS 9.2 STATISTICAL ANALYSIS

FORMULATING SWEETENER

```
Data compare;
Input con trt sweet;
Cards;
1    A    3
42   C    6
; Proc glm;
Class trt;
Model sweet = trt;
Means trt/dunnett ("A");
Means trt/lsd;
Run;
Quit;
```

The GLM Procedure

Class Level Information

Class	Levels	Values
Trt	3	A B C

Number of observations 126

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The GLM Procedure

Dependent Variable: sweet

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	69.9047619	34.9523810	9.47	0.0001
Error	123	453.8273810	3.6896535		
Corrected Total	125	523.7321429			

R-Square	Coeff Var	Root MSE	sweet Mean
0.133474	29.60572	1.920847	6.488095

Source	DF	Type I SS	Mean Square	F Value	Pr > F
trt	2	69.90476190	34.95238095	9.47	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
trt	2	69.90476190	34.95238095	9.47	0.0001

The GLM Procedure

Dunnett's t Tests for sweet

NOTE: This test controls the Type I experimentwise error for comparisons of all treatments against a

control.

Alpha	0.05
Error Degrees of Freedom	123
Error Mean Square	3.689654
Critical Value of Dunnett's t	2.23776
Minimum Significant Difference	0.938

Comparisons significant at the 0.05 level are indicated by ***.

trt Comparison	Difference Between Means	Simultaneous 95% Confidence Limits		
B - A	-1.4762	-2.4142	-0.5382	***
C - A	-1.6667	-2.6047	-0.7287	***

The GLM Procedure

t Tests (LSD) for sweet

NOTE: This test controls the Type I comparisonwise error rate, not the experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	123
Error Mean Square	3.689654
Critical Value of t	1.97944
Least Significant Difference	0.8297

Means with the same letter are not significantly different.

t Grouping	Mean	N	trt
A	7.5357	42	A
B	6.0595	42	B
B			
B	5.8690	42	C

FORMULATING FLAVORS

GREEN

```
Data green;
input con
sw$ flc in
OL;
cards;
          1  stevia   1        7        7
         30  stevia   3        7        6

proc anova data = green;
class con sw flc in ol;
```

model ol in = con sw flc sw*flc;

means sw/tukey cldiff;

means flc/tukey cldiff;

run;

The ANOVA Procedure

Class Level Information

Class	Levels	Values
con	30	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
sw	2	stevia sugar
flc	3	1 2 3
in	10	0 2 3 4 5 6 7 8 9 10
OL	9	1 2 3 4 5 6 7 8 9

Number of Observations Read 180

Number of Observations Used 180

The ANOVA Procedure

Dependent Variable: OL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	34	269.0000000	7.9117647	3.20	<.0001
Error	145	358.2000000	2.4703448		
Corrected Total	179	627.2000000			

R-Square	Coeff Var	Root MSE	OL Mean
0.428890	28.06666	1.571733	5.600000

Source	DF	Anova SS	Mean Square	F Value	Pr > F
con	29	238.2000000	8.2137931	3.32	<.0001
sw	1	25.6888889	25.6888889	10.40	0.0016
flc	2	1.2333333	0.6166667	0.25	0.7794
sw*flc	2	3.8777778	1.9388889	0.78	0.4581

The ANOVA Procedure

Dependent Variable: in

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	34	278.2555556	8.1839869	2.28	0.0004

Error	145	520.7388889	3.5913027
Corrected Total	179	798.9944444	

R-Square	Coeff Var	Root MSE	in Mean
0.348257	31.61383	1.895073	5.994444

Source	DF	Anova SS	Mean Square	F Value	Pr > F
con	29	242.4944444	8.3618774	2.33	0.0006
sw	1	3.4722222	3.4722222	0.97	0.3271
flc	2	29.8777778	14.9388889	4.16	0.0175
sw*flc	2	2.4111111	1.2055556	0.34	0.7154

The ANOVA Procedure

Tukey's Studentized Range (HSD) Test for OL

NOTE: This test controls the Type I experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	145
Error Mean Square	2.470345
Critical Value of Studentized Range	2.79514
Minimum Significant Difference	0.4631

Comparisons significant at the 0.05 level are indicated by ***.

sw Comparison	Difference Between Means	Simultaneous 95% Confidence Limits	
sugar - stevia	0.7556	0.2925	1.2186 ***
stevia - sugar	-0.7556	-1.2186	-0.2925 ***

The ANOVA Procedure

Tukey's Studentized Range (HSD) Test for in

NOTE: This test controls the Type I experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	145
Error Mean Square	3.591303
Critical Value of Studentized Range	2.79514
Minimum Significant Difference	0.5584

Comparisons significant at the 0.05 level are indicated by ***.

	Difference	Simultaneous

sw Comparison	Between Means	95% Confidence Limits
sugar - stevia	0.2778	-0.2806 0.8361
stevia - sugar	-0.2778	-0.8361 0.2806

The ANOVA Procedure

Tukey's Studentized Range (HSD) Test for OL

NOTE: This test controls the Type I experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	145
Error Mean Square	2.470345
Critical Value of Studentized Range	3.34890
Minimum Significant Difference	0.6795

Comparisons significant at the 0.05 level are indicated by ***.

flc Comparison	Difference Between Means	Simultaneous 95% Confidence Limits
3 - 2	0.0167	-0.6629 0.6962
3 - 1	0.1833	-0.4962 0.8629
2 - 3	-0.0167	-0.6962 0.6629

2 - 1	0.1667	-0.5129	0.8462
1 - 3	-0.1833	-0.8629	0.4962
1 - 2	-0.1667	-0.8462	0.5129

The ANOVA Procedure

Tukey's Studentized Range (HSD) Test for in

NOTE: This test controls the Type I experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	145
Error Mean Square	3.591303
Critical Value of Studentized Range	3.34890
Minimum Significant Difference	0.8193

Comparisons significant at the 0.05 level are indicated by ***.

flc Comparison	Difference Between Means	Simultaneous 95% Confidence Limits		
3 - 1	0.8000	-0.0193	1.6193	
3 - 2	0.9167	0.0973	1.7360	***
1 - 3	-0.8000	-1.6193	0.0193	
1 - 2	0.1167	-0.7027	0.9360	
2 - 3	-0.9167	-1.7360	-0.0973	***

2 - 1 -0.1167 -0.9360 0.7027

LEMON

```
data lemon;

input con sw$ flc in OL;

cards;

1       stevia  1       10      8

30      stevia  3       7       9

;
proc anova data = lemon;
class con sw flc in ol;
model ol in = con sw flc sw*flc;
means sw/tukey cldiff;
means flc/tukey cldiff;
run;
```

Class Levels Values

con 30 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

sw 2 stevia sugar

flc 3 1 2 3

in 14 0 1 2 3 4 5 5.5 6 6.5 7 7.5 8 9 10

OL 9 1 2 3 4 5 6 7 8 9

Number of Observations Read 180

Number of Observations Used 180

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The ANOVA Procedure

Dependent Variable: OL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	34	321.4888889	9.4555556	3.66	<.0001
Error	145	374.4888889	2.5826820		
Corrected Total	179	695.9777778			

R-Square	Coeff Var	Root MSE	OL Mean
0.461924	30.83934	1.607072	5.211111

Source	DF	Anova SS	Mean Square	F Value	Pr > F
con	29	283.9777778	9.7923372	3.79	<.0001
sw	1	18.6888889	18.6888889	7.24	0.0080
flc	2	4.6777778	2.3388889	0.91	0.4066
sw*flc	2	14.1444444	7.0722222	2.74	0.0680

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The ANOVA Procedure

Dependent Variable: in

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	34	441.2305556	12.9773693	4.41	<.0001
Error	145	426.2847222	2.9398946		
Corrected Total	179	867.5152778			

R-Square	Coeff Var	Root MSE	in Mean
0.508614	28.27578	1.714612	6.063889

Source	DF	Anova SS	Mean Square	F Value	Pr > F
con	29	421.3069444	14.5278257	4.94	<.0001
sw	1	5.8680556	5.8680556	2.00	0.1599
flc	2	4.6694444	2.3347222	0.79	0.4539
sw*flc	2	9.3861111	4.6930556	1.60	0.2062

The ANOVA Procedure

Tukey's Studentized Range (HSD) Test for OL

NOTE: This test controls the Type I experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	145
Error Mean Square	2.582682
Critical Value of Studentized Range	2.79514
Minimum Significant Difference	0.4735

Comparisons significant at the 0.05 level are indicated by ***.

sw Comparison	Difference Between Means	Simultaneous 95% Confidence Limits	
sugar - stevia	0.6444	0.1709	1.1179 ***
stevia - sugar	-0.6444	-1.1179	-0.1709 ***

The ANOVA Procedure

Tukey's Studentized Range (HSD) Test for in

NOTE: This test controls the Type I experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	145

Error Mean Square	2.939895
Critical Value of Studentized Range	2.79514
Minimum Significant Difference	0.5052

Comparisons significant at the 0.05 level are indicated by ***.

sw Comparison	Difference Between Means	Simultaneous 95% Confidence Limits	
sugar - stevia	0.3611	-0.1441	0.8663
stevia - sugar	-0.3611	-0.8663	0.1441

The ANOVA Procedure

Tukey's Studentized Range (HSD) Test for OL

NOTE: This test controls the Type I experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	145
Error Mean Square	2.582682
Critical Value of Studentized Range	3.34890
Minimum Significant Difference	0.6948

Comparisons significant at the 0.05 level are indicated by ***.

flc Comparison	Difference Between Means	Simultaneous 95% Confidence Limits	
1 - 2	0.0167	-0.6781	0.7115
1 - 3	0.3500	-0.3448	1.0448
2 - 1	-0.0167	-0.7115	0.6781
2 - 3	0.3333	-0.3615	1.0281
3 - 1	-0.3500	-1.0448	0.3448
3 - 2	-0.3333	-1.0281	0.3615

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The ANOVA Procedure

Tukey's Studentized Range (HSD) Test for in

NOTE: This test controls the Type I experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	145
Error Mean Square	2.939895
Critical Value of Studentized Range	3.34890
Minimum Significant Difference	0.7413

Comparisons significant at the 0.05 level are indicated by ***.

	Difference	Simultaneous

flc Comparison	Between Means	95% Confidence Limits	
2 - 1	0.3417	-0.3996	1.0830
2 - 3	0.3417	-0.3996	1.0830
1 - 2	-0.3417	-1.0830	0.3996
1 - 3	0.0000	-0.7413	0.7413
3 - 2	-0.3417	-1.0830	0.3996
3 - 1	0.0000	-0.7413	0.7413

ORANGE

```
data orange;

input con sw$ flc in OL;

cards;

1       stevia  1       10      3

1       sugar   1       10      2

30      stevia  3       4       5

;

proc anova data = orange;

class con sw flc in ol;

model ol in = con sw flc sw*flc;

means sw/tukey cldiff;

means flc/tukey cldiff;
```

run;

The ANOVA Procedure

Class Level Information

Class	Levels	Values
con	30	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
sw	2	stevia sugar
flc	3	1 2 3
in	15	0 1 2 2.5 3 4 5 6 6.5 7 7.5 8 8.5 9 10
OL	9	1 2 3 4 5 6 7 8 9

Number of Observations Read 180

Number of Observations Used 180

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The ANOVA Procedure

Dependent Variable: OL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F

Model	34	177.5888889	5.2232026	1.61	0.0294
Error	145	471.8055556	3.2538314		
Corrected Total	179	649.3944444			

R-Square	Coeff Var	Root MSE	OL Mean
0.273468	33.37008	1.803838	5.405556

Source	DF	Anova SS	Mean Square	F Value	Pr > F
con	29	139.2277778	4.8009579	1.48	0.0709
sw	1	28.0055556	28.0055556	8.61	0.0039
flc	2	3.8111111	1.9055556	0.59	0.5581
sw*flc	2	6.5444444	3.2722222	1.01	0.3683

The ANOVA Procedure

Dependent Variable: in

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	34	409.2083333	12.0355392	4.31	<.0001
Error	145	404.7291667	2.7912356		

Corrected Total 179 813.9375000

R-Square	Coeff Var	Root MSE	in Mean
0.502752	25.86889	1.670699	6.458333

Source	DF	Anova SS	Mean Square	F Value	Pr > F
con	29	381.2291667	13.1458333	4.71	<.0001
sw	1	4.8347222	4.8347222	1.73	0.1902
flc	2	0.3583333	0.1791667	0.06	0.9379
sw*flc	2	22.7861111	11.3930556	4.08	0.0189

The ANOVA Procedure

Tukey's Studentized Range (HSD) Test for OL

NOTE: This test controls the Type I experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	145
Error Mean Square	3.253831
Critical Value of Studentized Range	2.79514
Minimum Significant Difference	0.5315

Comparisons significant at the 0.05 level are indicated by ***.

sw Comparison	Difference Between Means	Simultaneous 95% Confidence Limits	
sugar - stevia	0.7889	0.2574	1.3204 ***
stevia - sugar	-0.7889	-1.3204	-0.2574 ***

The ANOVA Procedure

Tukey's Studentized Range (HSD) Test for in

NOTE: This test controls the Type I experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	145
Error Mean Square	2.791236
Critical Value of Studentized Range	2.79514
Minimum Significant Difference	0.4922

Comparisons significant at the 0.05 level are indicated by ***.

sw Comparison	Difference Between Means	Simultaneous 95% Confidence Limits	

sugar - stevia	0.3278	-0.1645	0.8200
stevia - sugar	-0.3278	-0.8200	0.1645

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The ANOVA Procedure

Tukey's Studentized Range (HSD) Test for OL

NOTE: This test controls the Type I experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	145
Error Mean Square	3.253831
Critical Value of Studentized Range	3.34890
Minimum Significant Difference	0.7799

Comparisons significant at the 0.05 level are indicated by ***.

flc Comparison	Difference Between Means	Simultaneous 95% Confidence Limits	
1 - 2	0.0167	-0.7632	0.7965
1 - 3	0.3167	-0.4632	1.0965
2 - 1	-0.0167	-0.7965	0.7632
2 - 3	0.3000	-0.4799	1.0799
3 - 1	-0.3167	-1.0965	0.4632
3 - 2	-0.3000	-1.0799	0.4799

STRAWBERRY

```
data strawberry;

input con sw$ flc in OL;

cards;

1       stevia   1       3       3
30      stevia   3       8       7


proc anova data = strawberry;
class con sw flc in ol;
model ol in = con sw flc sw*flc;
means sw/tukey cldiff;
means flc/tukey cldiff;
run;
```

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The ANOVA Procedure

Class Level Information

Class	Levels	Values
con	30	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
sw	2	stevia sugar

flc 3 1 2 3

in 10 1 2 3 4 5 6 7 8 9 10

OL 9 1 2 3 4 5 6 7 8 9

Number of Observations Read 180

Number of Observations Used 180

The ANOVA Procedure

Dependent Variable: OL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	34	287.8888889	8.4673203	4.28	<.0001
Error	145	287.0888889	1.9799234		
Corrected Total	179	574.9777778			

R-Square	Coeff Var	Root MSE	OL Mean
0.500696	25.53201	1.407097	5.511111

Source	DF	Anova SS	Mean Square	F Value	Pr > F

con	29	261.3111111	9.0107280	4.55 <.0001
sw	1	25.6888889	25.6888889	12.97 0.0004
flc	2	0.3111111	0.1555556	0.08 0.9245
sw*flc	2	0.5777778	0.2888889	0.15 0.8644

The ANOVA Procedure

Dependent Variable: in

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	34	256.7222222	7.5506536	2.33	0.0003
Error	145	469.3388889	3.2368199		
Corrected Total	179	726.0611111			

R-Square	Coeff Var	Root MSE	in Mean
0.353582	30.35061	1.799116	5.927778

Source	DF	Anova SS	Mean Square	F Value	Pr > F
con	29	209.8944444	7.2377395	2.24	0.0010
sw	1	42.0500000	42.0500000	12.99	0.0004
flc	2	4.7444444	2.3722222	0.73	0.4823

sw*flc	2	0.0333333	0.0166667	0.01 0.9949

The ANOVA Procedure

Tukey's Studentized Range (HSD) Test for OL

NOTE: This test controls the Type I experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	145
Error Mean Square	1.979923
Critical Value of Studentized Range	2.79514
Minimum Significant Difference	0.4146

Comparisons significant at the 0.05 level are indicated by ***.

sw Comparison	Difference Between Means	Simultaneous 95% Confidence Limits		
sugar - stevia	0.7556	0.3410	1.1701	***
stevia - sugar	-0.7556	-1.1701	-0.3410	***

The ANOVA Procedure

Tukey's Studentized Range (HSD) Test for in

NOTE: This test controls the Type I experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	145
Error Mean Square	3.23682
Critical Value of Studentized Range	2.79514
Minimum Significant Difference	0.5301

Comparisons significant at the 0.05 level are indicated by ***.

sw Comparison	Difference Between Means	Simultaneous 95% Confidence Limits		
sugar - stevia	0.9667	0.4366	1.4967	***
stevia - sugar	-0.9667	-1.4967	-0.4366	***

The ANOVA Procedure

Tukey's Studentized Range (HSD) Test for OL

NOTE: This test controls the Type I experiment wise error rate.

Alpha	0.05
Error Degrees of Freedom	145

Error Mean Square	1.979923
Critical Value of Studentized Range	3.34890
Minimum Significant Difference	0.6083

Comparisons significant at the 0.05 level are indicated by ***.

flc Comparison	Difference Between Means	Simultaneous 95% Confidence Limits	
3 - 2	0.0667	-0.5417	0.6750
3 - 1	0.1000	-0.5083	0.7083
2 - 3	-0.0667	-0.6750	0.5417
2 - 1	0.0333	-0.5750	0.6417
1 - 3	-0.1000	-0.7083	0.5083
1 - 2	-0.0333	-0.6417	0.5750

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The ANOVA Procedure

Tukey's Studentized Range (HSD) Test for in

NOTE: This test controls the Type I experimentwise error rate.

Alpha	0.05
Error Degrees of Freedom	145
Error Mean Square	3.23682
Critical Value of Studentized Range	3.34890

Minimum Significant Difference 0.7778

Comparisons significant at the 0.05 level are indicated by ***.

flc Comparison	Difference Between Means	Simultaneous 95% Confidence Limits	
3 - 2	0.0500	-0.7278	0.8278
3 - 1	0.3667	-0.4112	1.1445
2 - 3	-0.0500	-0.8278	0.7278
2 - 1	0.3167	-0.4612	1.0945
1 - 3	-0.3667	-1.1445	0.4112
1 - 2	-0.3167	-1.0945	0.4612

CONSUMER TEST

```
data test;
input con flavor$ swt$ trt sweetIN aftaste bitter astringent OL;
cards;
1    lemon  stevia  1    9    10   0    1    6
120  straw  sugar   8    9    1    0    1    6
;
*/proc print data = test;
```

```
proc glm data=test;

class con flavor swt trt sweetIN aftaste bitter astringent OL;

model sweetIN aftaste bitter astringent OL = flavor swt flavor*swt;

lsmeans flavor/stderr pdiff;

lsmeans swt/stderr pdiff;

lsmeans flavor*swt/slice = flavor;

lsmeans flavor*swt/slice = swt;

run;

quit;
```

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The GLM Procedure

Class Level Information

Class	Levels	Values
con	120	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120
flavor	4	green lemon orange straw

swt 2 stevia sugar

trt 8 1 2 3 4 5 6 7 8

sweetIN 16 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

aftaste 20 0 0.5 1 1.5 2 2.5 3 3.5 4 5 6 7 8 9 10 11 12 13 14 15

bitter 2 0 1

astringent 2 0 1

OL 9 1 2 3 4 5 6 7 8 9

Number of Observations Read 960

Number of Observations Used 951

The GLM Procedure

Dependent Variable: sweetIN

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	1030.80333	147.25762	9.41	<.0001
Error	943	14753.18616	15.64495		
Corrected Total	950	15783.98948			

R-Square	Coeff Var	Root MSE	sweetIN Mean
0.065307	49.24148	3.955370	8.032597

Source	DF	Type I SS	Mean Square	F Value	Pr > F
flavor	3	127.1776208	42.3925403	2.71	0.0440
swt	1	872.3872325	872.3872325	55.76	<.0001
flavor*swt	3	31.2384757	10.4128252	0.67	0.5733

Source	DF	Type III SS	Mean Square	F Value	Pr > F
flavor	3	126.7159410	42.2386470	2.70	0.0446
swt	1	872.9183482	872.9183482	55.80	<.0001
flavor*swt	3	31.2384757	10.4128252	0.67	0.5733

The GLM Procedure

Dependent Variable: aftaste

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	214.42835	30.63262	1.65	0.1166
Error	943	17457.31192	18.51253		

Corrected Total	950	17671.74027

R-Square	Coeff Var	Root MSE	aftaste Mean
0.012134	74.47743	4.302618	5.777077

Source	DF	Type I SS	Mean Square	F Value	Pr > F
flavor	3	131.6360026	43.8786675	2.37	0.0692
swt	1	80.2998043	80.2998043	4.34	0.0375
flavor*swt	3	2.4925452	0.8308484	0.04	0.9874

Source	DF	Type III SS	Mean Square	F Value	Pr > F
flavor	3	131.7219472	43.9073157	2.37	0.0690
swt	1	80.3400683	80.3400683	4.34	0.0375
flavor*swt	3	2.4925452	0.8308484	0.04	0.9874

The GLM Procedure

Dependent Variable: bitter

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	17.3994129	2.4856304	12.67	<.0001

Error	943	184.9433841	0.1961224
Corrected Total	950	202.3427971	

R-Square	Coeff Var	Root MSE	bitter Mean
0.085990	144.2319	0.442857	0.307045

Source	DF	Type I SS	Mean Square	F Value	Pr > F
flavor	3	1.64953747	0.54984582	2.80	0.0388
swt	1	15.05695564	15.05695564	76.77	<.0001
flavor*swt	3	0.69291981	0.23097327	1.18	0.3171

Source	DF	Type III SS	Mean Square	F Value	Pr > F
flavor	3	1.63991740	0.54663913	2.79	0.0397
swt	1	15.06525932	15.06525932	76.82	<.0001
flavor*swt	3	0.69291981	0.23097327	1.18	0.3171

The GLM Procedure

Dependent Variable: astringent

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F

Model	7	17.3952473	2.4850353	10.78 <.0001
Error	943	217.4564877	0.2306007	
Corrected Total	950	234.8517350		

R-Square	Coeff Var	Root MSE	astringent Mean
0.074069	107.9619	0.480209	0.444795

Source	DF	Type I SS	Mean Square	F Value	Pr > F
flavor	3	0.50671853	0.16890618	0.73	0.5327
swt	1	16.85210211	16.85210211	73.08	<.0001
flavor*swt	3	0.03642670	0.01214223	0.05	0.9841

Source	DF	Type III SS	Mean Square	F Value	Pr > F
flavor	3	0.51736163	0.17245388	0.75	0.5237
swt	1	16.85209798	16.85209798	73.08	<.0001
flavor*swt	3	0.03642670	0.01214223	0.05	0.9841

The GLM Procedure

Dependent Variable: OL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	296.388858	42.341265	10.80	<.0001
Error	943	3695.600627	3.918983		
Corrected Total	950	3991.989485			

R-Square	Coeff Var	Root MSE	OL Mean
0.074246	39.85266	1.979642	4.967403

Source	DF	Type I SS	Mean Square	F Value	Pr > F
flavor	3	228.2394227	76.0798076	19.41	<.0001
swt	1	46.9519202	46.9519202	11.98	0.0006
flavor*swt	3	21.1975152	7.0658384	1.80	0.1450

Source	DF	Type III SS	Mean Square	F Value	Pr > F
flavor	3	228.4326584	76.1442195	19.43	<.0001
swt	1	46.9793208	46.9793208	11.99	0.0006
flavor*swt	3	21.1975152	7.0658384	1.80	0.1450

The GLM Procedure

Least Squares Means

flavor	sweetIN LSMEAN	Standard Error	Pr > |t|	LSMEAN Number
green	7.68487395	0.25638853	<.0001	1
lemon	7.84909557	0.25693115	<.0001	2
orange	7.95798319	0.25638853	<.0001	3
straw	8.64285714	0.25638853	<.0001	4

Least Squares Means for effect flavor

Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: sweetIN

i/j	1	2	3	4
1		0.6511	0.4515	0.0084
2	0.6511		0.7643	0.0290
3	0.4515	0.7643		0.0592
4	0.0084	0.0290	0.0592	

flavor	aftaste LSMEAN	Standard Error	Pr > |t|	LSMEAN Number
green	6.26680672	0.27889733	<.0001	1
lemon	5.65670845	0.27948759	<.0001	2
orange	5.25210084	0.27889733	<.0001	3
straw	5.93067227	0.27889733	<.0001	4

Least Squares Means for effect flavor

Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: aftaste

i/j	1	2	3	4
1		0.1226	0.0102	0.3943
2	0.1226		0.3057	0.4879
3	0.0102	0.3057		0.0857
4	0.3943	0.4879	0.0857	

flavor	bitter LSMEAN	Standard Error	Pr > |t|	LSMEAN Number
green	0.32773109	0.02870616	<.0001	1
lemon	0.33688221	0.02876691	<.0001	2
orange	0.32773109	0.02870616	<.0001	3

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The GLM Procedure

Least Squares Means

flavor	bitter LSMEAN	Standard Error	Pr > |t|	LSMEAN Number
straw	0.23529412	0.02870616	<.0001	4

Least Squares Means for effect flavor

Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: bitter

i/j	1	2	3	4
1		0.8219	1.0000	0.0230
2	0.8219		0.8219	0.0126
3	1.0000	0.8219		0.0230
4	0.0230	0.0126	0.0230	

flavor	astringent LSMEAN	Standard Error	Pr > |t|	LSMEAN Number
green	0.45378151	0.03112733	<.0001	1
lemon	0.40450078	0.03119321	<.0001	2
orange	0.46218487	0.03112733	<.0001	3
straw	0.45798319	0.03112733	<.0001	4

Least Squares Means for effect flavor

Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: astringent

i/j	1	2	3	4
1		0.2637	0.8486	0.9240
2	0.2637		0.1909	0.2252

3	0.8486	0.1909		0.9240
4	0.9240	0.2252	0.9240	

flavor	OL LSMEAN	Standard Error	LSMEAN Pr > |t|	Number
green	4.43277311	0.12832113	<.0001	1
lemon	5.30921521	0.12859271	<.0001	2
orange	4.54621849	0.12832113	<.0001	3
straw	5.58403361	0.12832113	<.0001	4

The GLM Procedure

Least Squares Means

Least Squares Means for effect flavor

Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: OL

i/j	1	2	3	4
1		<.0001	0.5320	<.0001
2	<.0001		<.0001	0.1307
3	0.5320	<.0001		<.0001
4	<.0001	0.1307	<.0001	

NOTE: To ensure overall protection level, only probabilities associated with pre-planned comparisons should be used.

The GLM Procedure

Least Squares Means

sweetIN swt	LSMEAN	Standard Error	H0:LSMEAN=0 Pr > |t|	H0:LSMean1= LSMean2 Pr > |t|
stevia	7.07563025	0.18129407	<.0001	<.0001
sugar	8.99177468	0.18148601	<.0001	

aftaste swt	LSMEAN	Standard Error	H0:LSMEAN=0 Pr > |t|	H0:LSMean1= LSMean2 Pr > |t|
stevia	6.06722689	0.19721020	<.0001	0.0375
sugar	5.48591725	0.19741899	<.0001	

bitter swt	LSMEAN	Standard Error	H0:LSMEAN=0 Pr > |t|	H0:LSMean1= LSMean2 Pr > |t|
stevia	0.43277311	0.02029832	<.0001	<.0001
sugar	0.18104615	0.02031981	<.0001	

astringent	Standard	H0:LSMEAN=0	H0:LSMean1= LSMean2

swt	LSMEAN	Error	Pr > |t|	Pr > |t|
stevia	0.57773109	0.02201035	<.0001	<.0001
sugar	0.31149409	0.02203365	<.0001	

swt	OL LSMEAN	Standard Error	H0:LSMEAN=0 Pr > |t|	H0:LSMean1= LSMean2 Pr > |t|
stevia	4.74579832	0.09073674	<.0001	0.0006
sugar	5.19032189	0.09083281	<.0001	

The GLM Procedure

Least Squares Means

flavor	swt	sweetIN LSMEAN	aftaste LSMEAN	bitter LSMEAN	astringent LSMEAN	OL LSMEAN
green	stevia	6.89075630	6.51260504	0.46218487	0.59663866	4.45378151
green	sugar	8.47899160	6.02100840	0.19327731	0.31092437	4.41176471
lemon	stevia	6.61344538	6.01680672	0.49579832	0.53781513	5.02521008
lemon	sugar	9.08474576	5.29661017	0.17796610	0.27118644	5.59322034
orange	stevia	7.15966387	5.57142857	0.45378151	0.58823529	4.30252101
orange	sugar	8.75630252	4.93277311	0.20168067	0.33613445	4.78991597
straw	stevia	7.63865546	6.16806723	0.31932773	0.58823529	5.20168067
straw	sugar	9.64705882	5.69327731	0.15126050	0.32773109	5.96638655

The GLM Procedure

Least Squares Means

flavor*swt Effect Sliced by flavor for sweetIN

flavor	DF	Sum of Squares	Mean Square	F Value	Pr > F
green	1	150.088235	150.088235	9.59	0.0020
lemon	1	361.852599	361.852599	23.13	<.0001
orange	1	151.680672	151.680672	9.70	0.0019
straw	1	240.004202	240.004202	15.34	<.0001

The GLM Procedure

Least Squares Means

flavor*swt Effect Sliced by flavor for aftaste

flavor	DF	Sum of Squares	Mean Square	F Value	Pr > F
green	1	14.379202	14.379202	0.78	0.3784
lemon	1	30.731425	30.731425	1.66	0.1979
orange	1	24.268908	24.268908	1.31	0.2525
straw	1	13.412815	13.412815	0.72	0.3949

The GLM Procedure

Least Squares Means

flavor*swt Effect Sliced by flavor for bitter

flavor	DF	Sum of Squares	Mean Square	F Value	Pr > F
green	1	4.302521	4.302521	21.94	<.0001
lemon	1	5.985170	5.985170	30.52	<.0001
orange	1	3.781513	3.781513	19.28	<.0001
straw	1	1.680672	1.680672	8.57	0.0035

The GLM Procedure

Least Squares Means

flavor*swt Effect Sliced by flavor for astringent

flavor	DF	Sum of Squares	Mean Square	F Value	Pr > F
green	1	4.857143	4.857143	21.06	<.0001
lemon	1	4.212058	4.212058	18.27	<.0001
orange	1	3.781513	3.781513	16.40	<.0001
straw	1	4.037815	4.037815	17.51	<.0001

The GLM Procedure

Least Squares Means

flavor*swt Effect Sliced by flavor for OL

Sum of

flavor	DF	Squares	Mean Square	F Value	Pr > F
green	1	0.105042	0.105042	0.03	0.8700
lemon	1	19.115822	19.115822	4.88	0.0274
orange	1	14.134454	14.134454	3.61	0.0579
straw	1	34.794118	34.794118	8.88	0.0030

The GLM Procedure

Least Squares Means

flavor	swt	sweetIN LSMEAN	aftaste LSMEAN	bitter LSMEAN	astringent LSMEAN	OL LSMEAN
green	stevia	6.89075630	6.51260504	0.46218487	0.59663866	4.45378151
green	sugar	8.47899160	6.02100840	0.19327731	0.31092437	4.41176471
lemon	stevia	6.61344538	6.01680672	0.49579832	0.53781513	5.02521008
lemon	sugar	9.08474576	5.29661017	0.17796610	0.27118644	5.59322034
orange	stevia	7.15966387	5.57142857	0.45378151	0.58823529	4.30252101
orange	sugar	8.75630252	4.93277311	0.20168067	0.33613445	4.78991597
straw	stevia	7.63865546	6.16806723	0.31932773	0.58823529	5.20168067
straw	sugar	9.64705882	5.69327731	0.15126050	0.32773109	5.96638655

The GLM Procedure

Least Squares Means

flavor*swt Effect Sliced by swt for sweetIN

Sum of

swt	DF	Squares	Mean Square	F Value	Pr > F
stevia	3	68.050420	22.683473	1.45	0.2268
sugar	3	90.007051	30.002350	1.92	0.1250

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The GLM Procedure

Least Squares Means

flavor*swt Effect Sliced by swt for aftaste

swt	DF	Sum of Squares	Mean Square	F Value	Pr > F
stevia	3	54.369748	18.123249	0.98	0.4019
sugar	3	79.828123	26.609374	1.44	0.2304

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The GLM Procedure

Least Squares Means

flavor*swt Effect Sliced by swt for bitter

swt	DF	Sum of Squares	Mean Square	F Value	Pr > F
stevia	3	2.159664	0.719888	3.67	0.0120
sugar	3	0.175165	0.058388	0.30	0.8271

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The GLM Procedure

Least Squares Means

flavor*swt Effect Sliced by swt for astringent

swt	DF	Sum of Squares	Mean Square	F Value	Pr > F
stevia	3	0.258403	0.086134	0.37	0.7721
sugar	3	0.295374	0.098458	0.43	0.7337

The GLM Procedure

Least Squares Means

flavor*swt Effect Sliced by swt for OL

swt	DF	Sum of Squares	Mean Square	F Value	Pr > F
stevia	3	67.552521	22.517507	5.75	0.0007
sugar	3	182.035817	60.678606	15.48	<.0001

TREATMENTS ANALYSIS

```
data test;
input con trt sweetIN aftaste bitter astringent OL;
cards;
1 1 9 10 0 1 0 6
```

120 8 9 1 0 1 0 6

```
proc glm data=test;
class con trt sweetIN aftaste bitter astringent OL;
model sweetIN aftaste bitter astringent OL = trt;
lsmeans trt/stderr pdiff;
run;
quit;
```

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The GLM Procedure

Class Level Information

Class	Levels	Values
con	120	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120
trt	8	1 2 3 4 5 6 7 8
sweetIN	17	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 19
aftaste	20	0 0.5 1 1.5 2 2.5 3 3.5 4 5 6 7 8 9 10 11 12 13 14 15

bitter 3 0 1 8

astringent 3 0 1 7

OL 4 0 1 3 6

Number of Observations Read 960

Number of Observations Used 960

The GLM Procedure

Dependent Variable: sweetIN

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	1063.98229	151.99747	9.71	<.0001
Error	952	14895.09167	15.64610		
Corrected Total	959	15959.07396			

R-Square	Coeff Var	Root MSE	sweetIN Mean
0.066669	49.16865	3.955516	8.044792

Source	DF	Type I SS	Mean Square	F Value	Pr > F
trt	7	1063.982292	151.997470	9.71	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
trt	7	1063.982292	151.997470	9.71	<.0001

The GLM Procedure

Dependent Variable: aftaste

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	204.07500	29.15357	1.58	0.1362
Error	952	17516.98750	18.40020		
Corrected Total	959	17721.06250			

R-Square	Coeff Var	Root MSE	aftaste Mean
0.011516	74.19754	4.289545	5.781250

Source	DF	Type I SS	Mean Square	F Value	Pr > F

trt	7	204.0750000	29.1535714	1.58	0.1362

Source	DF	Type III SS	Mean Square	F Value	Pr > F
trt	7	204.0750000	29.1535714	1.58	0.1362

The GLM Procedure

Dependent Variable: bitter

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	14.7458333	2.1065476	6.50	<.0001
Error	952	308.5500000	0.3241071		
Corrected Total	959	323.2958333			

R-Square	Coeff Var	Root MSE	bitter Mean
0.045611	174.0548	0.569304	0.327083

Source	DF	Type I SS	Mean Square	F Value	Pr > F
trt	7	14.74583333	2.10654762	6.50	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
trt	7	14.74583333	2.10654762	6.50	<.0001

The GLM Procedure

Dependent Variable: astringent

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	13.7239583	1.9605655	6.05	<.0001
Error	952	308.6916667	0.3242560		
Corrected Total	959	322.4156250			

R-Square	Coeff Var	Root MSE	astringent Mean
0.042566	123.9586	0.569435	0.459375

Source	DF	Type I SS	Mean Square	F Value	Pr > F
trt	7	13.72395833	1.96056548	6.05	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F

trt	7	13.72395833	1.96056548	6.05 <.0001

The GLM Procedure

Dependent Variable: OL

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	0.58333333	0.08333333	1.20	0.3023
Error	952	66.35000000	0.06969538		
Corrected Total	959	66.93333333			

R-Square	Coeff Var	Root MSE	OL Mean
0.008715	791.9965	0.263999	0.033333

Source	DF	Type I SS	Mean Square	F Value	Pr > F
trt	7	0.58333333	0.08333333	1.20	0.3023

Source	DF	Type III SS	Mean Square	F Value	Pr > F
trt	7	0.58333333	0.08333333	1.20	0.3023

The GLM Procedure

Least Squares Means

trt	sweetIN LSMEAN	Standard Error	Pr > |t|	LSMEAN Number
1	6.64166667	0.36108753	<.0001	1
2	9.13333333	0.36108753	<.0001	2
3	6.83333333	0.36108753	<.0001	3
4	8.49166667	0.36108753	<.0001	4
5	7.17500000	0.36108753	<.0001	5
6	8.75833333	0.36108753	<.0001	6
7	7.65833333	0.36108753	<.0001	7
8	9.66666667	0.36108753	<.0001	8

Least Squares Means for effect trt

Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: sweetIN

i/j	1	2	3	4	5	6	7	8
1		<.0001	0.7075	0.0003	0.2966	<.0001	0.0468	<.0001
2	<.0001		<.0001	0.2092	0.0001	0.4629	0.0040	0.2966
3	0.7075	<.0001		0.0012	0.5036	0.0002	0.1065	<.0001
4	0.0003	0.2092	0.0012		0.0101	0.6016	0.1030	0.0216
5	0.2966	0.0001	0.5036	0.0101		0.0020	0.3441	<.0001
6	<.0001	0.4629	0.0002	0.6016	0.0020		0.0315	0.0756

7	0.0468	0.0040	0.1065	0.1030	0.3441	0.0315	<.0001
8	<.0001	0.2966	<.0001	0.0216	<.0001	0.0756	<.0001

trt	aftaste LSMEAN	Standard Error	Pr > |t|	LSMEAN Number
1	6.02500000	0.39158010	<.0001	1
2	5.31666667	0.39158010	<.0001	2
3	6.46666667	0.39158010	<.0001	3
4	6.02916667	0.39158010	<.0001	4
5	5.59166667	0.39158010	<.0001	5
6	4.94166667	0.39158010	<.0001	6
7	6.16666667	0.39158010	<.0001	7
8	5.71250000	0.39158010	<.0001	8

The GLM Procedure

Least Squares Means

Least Squares Means for effect trt

Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: aftaste

i/j	1	2	3	4	5	6	7	8
1		0.2012	0.4253	0.9940	0.4341	0.0507	0.7981	0.5727
2	0.2012		0.0381	0.1985	0.6196	0.4985	0.1251	0.4749
3	0.4253	0.0381		0.4297	0.1144	0.0060	0.5881	0.1736
4	0.9940	0.1985	0.4297		0.4297	0.0498	0.8040	0.5676

5	0.4341	0.6196	0.1144	0.4297	0.2408	0.2994	0.8273
6	0.0507	0.4985	0.0060	0.0498	0.2408	0.0272	0.1643
7	0.7981	0.1251	0.5881	0.8040	0.2994	0.0272	0.4124
8	0.5727	0.4749	0.1736	0.5676	0.8273	0.1643	0.4124

trt	bitter LSMEAN	Standard Error	LSMEAN Pr > |t|	Number
1	0.49166667	0.05197012	<.0001	1
2	0.30833333	0.05197012	<.0001	2
3	0.46666667	0.05197012	<.0001	3
4	0.20000000	0.05197012	0.0001	4
5	0.45833333	0.05197012	<.0001	5
6	0.20833333	0.05197012	<.0001	6
7	0.32500000	0.05197012	<.0001	7
8	0.15833333	0.05197012	0.0024	8

Least Squares Means for effect trt

Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: bitter

i/j	1	2	3	4	5	6	7	8
1		0.0128	0.7338	<.0001	0.6503	0.0001	0.0236	<.0001
2	0.0128		0.0315	0.1408	0.0415	0.1740	0.8207	0.0415
3	0.7338	0.0315		0.0003	0.9098	0.0005	0.0542	<.0001
4	<.0001	0.1408	0.0003		0.0005	0.9098	0.0893	0.5709
5	0.6503	0.0415	0.9098	0.0005		0.0007	0.0700	<.0001

6	0.0001	0.1740	0.0005	0.9098	0.0007	0.1128	0.4965
7	0.0236	0.8207	0.0542	0.0893	0.0700	0.1128	0.0236
8	<.0001	0.0415	<.0001	0.5709	<.0001	0.4965	0.0236

The GLM Procedure

Least Squares Means

trt	astringent LSMEAN	Standard Error	Pr > |t|	LSMEAN Number
1	0.54166667	0.05198204	<.0001	1
2	0.37500000	0.05198204	<.0001	2
3	0.59166667	0.05198204	<.0001	3
4	0.31666667	0.05198204	<.0001	4
5	0.59166667	0.05198204	<.0001	5
6	0.34166667	0.05198204	<.0001	6
7	0.58333333	0.05198204	<.0001	7
8	0.33333333	0.05198204	<.0001	8

Least Squares Means for effect trt

Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: astringent

i/j	1	2	3	4	5	6	7	8
1		0.0236	0.4966	0.0023	0.4966	0.0066	0.5710	0.0047

2	0.0236	0.0033	0.4277	0.0033	0.6503	0.0047	0.5710
3	0.4966	0.0033	0.0002	1.0000	0.0007	0.9098	0.0005
4	0.0023	0.4277	0.0002	0.0002	0.7339	0.0003	0.8207
5	0.4966	0.0033	1.0000	0.0002	0.0007	0.9098	0.0005
6	0.0066	0.6503	0.0007	0.7339	0.0007	0.0010	0.9098
7	0.5710	0.0047	0.9098	0.0003	0.9098	0.0010	0.0007
8	0.0047	0.5710	0.0005	0.8207	0.0005	0.9098	0.0007

trt	OL LSMEAN	Standard Error	LSMEAN Pr > |t|	Number
1	0.02500000	0.02409969	0.2998	1
2	0.08333333	0.02409969	0.0006	2
3	0.05833333	0.02409969	0.0157	3
4	0.01666667	0.02409969	0.4894	4
5	0.02500000	0.02409969	0.2998	5
6	0.00833333	0.02409969	0.7296	6
7	0.04166667	0.02409969	0.0841	7
8	0.00833333	0.02409969	0.7296	8

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The GLM Procedure

Least Squares Means

Least Squares Means for effect trt

Pr > |t| for H0: LSMean(i)=LSMean(j)

Dependent Variable: OL

i/j	1	2	3	4	5	6	7	8

1		0.0873	0.3283	0.8069	1.0000	0.6249	0.6249	0.6249
2	0.0873		0.4634	0.0508	0.0873	0.0280	0.2218	0.0280
3	0.3283	0.4634		0.2218	0.3283	0.1427	0.6249	0.1427
4	0.8069	0.0508	0.2218		0.8069	0.8069	0.4634	0.8069
5	1.0000	0.0873	0.3283	0.8069		0.6249	0.6249	0.6249
6	0.6249	0.0280	0.1427	0.8069	0.6249		0.3283	1.0000
7	0.6249	0.2218	0.6249	0.4634	0.6249	0.3283		0.3283
8	0.6249	0.0280	0.1427	0.8069	0.6249	1.0000	0.3283	

NOTE: To ensure overall protection level, only probabilities associated with pre-planned comparisons should be used.

GENDER ANALYSIS

FNS

```
data gender;
input con gender$ fns;
cards;
1       F       42
120     M       38
;
proc ttest data = gender;
class gender;
var fns;
```

run;

The SAS System 04:11 Monday, October 15, 2012 1

The TTEST Procedure

Variable: fns

gender	N	Mean	Std Dev	Std Err	Minimum	Maximum
F	69	36.7246	7.6387	0.9196	14.0000	51.0000
M	51	37.2549	7.2494	1.0151	16.0000	52.0000
Diff (1-2)		-0.5303	7.4762	1.3806		

gender	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
F		36.7246	34.8896	38.5597	7.6387	6.5427	9.1791
M		37.2549	35.2160	39.2938	7.2494	6.0656	9.0116
Diff (1-2)	Pooled	-0.5303	-3.2642	2.2037	7.4762	6.6319	8.5688
Diff (1-2)	Satterthwaite	-0.5303	-3.2445	2.1840			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	118	-0.38	0.7016
Satterthwaite	Unequal	110.85	-0.39	0.6994

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F

Folded F 68 50 1.11 0.7033

FIS

```
data gender;
input con gender$ fis;
cards;
1 F 47
120 M 42
;
proc ttest data = gender;
class gender;
var fis;
run;
```

The SAS System 04:14 Monday, October 15, 2012 1

The TTEST Procedure

Variable: fis

gender	N	Mean	Std Dev	Std Err	Minimum	Maximum

F	69	54.9420	6.6219	0.7972	42.0000	76.0000
M	51	54.3137	7.9611	1.1148	39.0000	69.0000
Diff (1-2)		0.6283	7.2198	1.3332		

gender	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
F		54.9420	53.3513	56.5328	6.6219	5.6718	7.9573
M		54.3137	52.0746	56.5528	7.9611	6.6612	9.8963
Diff (1-2)	Pooled	0.6283	-2.0118	3.2685	7.2198	6.4044	8.2749
Diff (1-2)	Satterthwaite	0.6283	-2.0922	3.3488			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	118	0.47	0.6383
Satterthwaite	Unequal	95.793	0.46	0.6477

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	50	68	1.45	0.1571

HTAS

```
data gender;
input con gender$ HTAS;
cards;
```

```
1       F       3.9
120     M       3.9 ;

proc ttest data = gender;

class gender;

var HTAS;

run;
```

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The TTEST Procedure

Variable: HTAS

gender	N	Mean	Std Dev	Std Err	Minimum	Maximum
F	69	161.8	13.1766	1.5863	120.0	205.0
M	51	168.0	14.6758	2.0550	147.0	208.0
Diff (1-2)		-6.2515	13.8317	2.5542		

gender	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
F		161.8	158.6	164.9	13.1766	11.2861	15.8337
M		168.0	163.9	172.1	14.6758	12.2794	18.2432
Diff (1-2)	Pooled	-6.2515	-11.3095	-1.1935	13.8317	12.2697	15.8531
Diff (1-2)	Satterthwaite	-6.2515	-11.4013	-1.1016			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	118	-2.45	0.0159
Satterthwaite	Unequal	100.98	-2.41	0.0179

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	50	68	1.24	0.4056

NATURAL

```
data gender;
input con gender$ natural;
cards;
 1          F          4.5
 120        M          4
; proc ttest data = gender;
class gender;
var natural;
run;
```

The SAS System 18:44 Thursday, October 18, 2012 1

The TTEST Procedure

Variable: Natural

gender	N	Mean	Std Dev	Std Err	Minimum	Maximum
F	69	4.0894	0.6414	0.0772	2.8333	5.6667
M	51	4.1503	0.6012	0.0842	2.8333	5.6667
Diff (1-2)		-0.0610	0.6247	0.1154		

gender	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
F		4.0894	3.9353	4.2435	0.6414	0.5494	0.7708
M		4.1503	3.9812	4.3194	0.6012	0.5030	0.7473
Diff (1-2)	Pooled	-0.0610	-0.2894	0.1675	0.6247	0.5541	0.7160
Diff (1-2)	Satterthwaite	-0.0610	-0.2873	0.1654			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	118	-0.53	0.5982
Satterthwaite	Unequal	111.5	-0.53	0.5947

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	68	50	1.14	0.6349

LIGHT

```
data gender;

input con gender$ light;

cards;

 1          F          4.333333

 120        M          4

;proc ttest data = gender;

class gender;

var light;

run;
```

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The TTEST Procedure

Variable: light

gender	N	Mean	Std Dev	Std Err	Minimum	Maximum
F	137	4.1341	0.7715	0.0659	2.2500	6.5000
M	102	4.3521	0.8083	0.0800	2.2500	6.5000
Diff (1-2)		-0.2180	0.7874	0.1030		

gender	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
F		4.1341	4.0038	4.2645	0.7715	0.6897	0.8754
M		4.3521	4.1934	4.5109	0.8083	0.7106	0.9375

Diff (1-2)	Pooled	-0.2180	-0.4209	-0.0151	0.7874	0.7224	0.8653
Diff (1-2)	Satterthwaite	-0.2180	-0.4224	-0.0136			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	237	-2.12	0.0353
Satterthwaite	Unequal	212.03	-2.10	0.0367

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	101	136	1.10	0.6091

CRAVINGS

```
data gender;
input con gender$ craving;
cards;
1       F       4.5
120     M       3.7

; proc ttest data = gender;
class gender;
var craving;
run;
```

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The TTEST Procedure

Variable: craving

gender	N	Mean	Std Dev	Std Err	Minimum	Maximum
F	69	4.3019	0.8995	0.1083	1.5000	6.6667
M	51	4.4706	1.0707	0.1499	2.0000	7.0000
Diff (1-2)		-0.1687	0.9757	0.1802		

gender	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
F		4.3019	4.0859	4.5180	0.8995	0.7704	1.0809
M		4.4706	4.1695	4.7717	1.0707	0.8958	1.3309
Diff (1-2)	Pooled	-0.1687	-0.5254	0.1881	0.9757	0.8655	1.1183
Diff (1-2)	Satterthwaite	-0.1687	-0.5357	0.1984			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	118	-0.94	0.3511
Satterthwaite	Unequal	96.469	-0.91	0.3641

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	50	68	1.42	0.1806

REWARD

```
data gender;
input con gender$ reward;
cards;
1       F       4.2
120     M       4.5

; proc ttest data = gender;
class gender;
var reward;
run;
```

The SAS System 18:50 Thursday, October 18, 2012 1

The TTEST Procedure

Variable: reward

gender	N	Mean	Std Dev	Std Err	Minimum	Maximum
F	69	4.4589	0.7923	0.0954	2.0000	6.3333
M	51	4.6863	0.8490	0.1189	2.0000	6.3333

Diff (1-2)		-0.2273	0.8168	0.1508		

gender	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
F		4.4589	4.2686	4.6493	0.7923	0.6787	0.9521
M		4.6863	4.4475	4.9250	0.8490	0.7103	1.0553
Diff (1-2)	Pooled	-0.2273	-0.5260	0.0714	0.8168	0.7246	0.9362
Diff (1-2)	Satterthwaite	-0.2273	-0.5296	0.0749			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	118	-1.51	0.1344
Satterthwaite	Unequal	103.55	-1.49	0.1389

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	50	68	1.15	0.5914

PLEASURE

```
data gender;

input con gender$ pleasure;

cards;

1       F       4.166667
120     M       5.333333


proc ttest data = gender;
```

```
class gender;

var pleasure;

run;
```

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The TTEST Procedure

Variable: pleasure

gender	N	Mean	Std Dev	Std Err	Minimum	Maximum
F	69	4.4372	0.6493	0.0782	3.1667	6.5000
M	51	4.5817	0.7633	0.1069	3.5000	6.1667
Diff (1-2)		-0.1445	0.6999	0.1292		

gender	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
F		4.4372	4.2812	4.5932	0.6493	0.5562	0.7803
M		4.5817	4.3670	4.7964	0.7633	0.6387	0.9488
Diff (1-2)	Pooled	-0.1445	-0.4004	0.1114	0.6999	0.6209	0.8022
Diff (1-2)	Satterthwaite	-0.1445	-0.4073	0.1183			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	118	-1.12	0.2658
Satterthwaite	Unequal	97.322	-1.09	0.2779

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	50	68	1.38	0.2138

GENERAL(ALL)

```
data gender;
input con gender$ general;
cards;
1       F       4.2
120     M       4.2

proc ttest data = gender;
class gender;
var general;
run;
```

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The TTEST Procedure

Variable: general

gender	N	Mean	Std Dev	Std Err	Minimum	Maximum
F	69	4.2571	0.3468	0.0417	3.1579	5.3947
M	51	4.4216	0.3862	0.0541	3.8684	5.4737
Diff (1-2)		-0.1645	0.3640	0.0672		

gender	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
F		4.2571	4.1738	4.3404	0.3468	0.2970	0.4167
M		4.4216	4.3129	4.5302	0.3862	0.3231	0.4801
Diff (1-2)	Pooled	-0.1645	-0.2976	-0.0314	0.3640	0.3229	0.4172
Diff (1-2)	Satterthwaite	-0.1645	-0.3000	-0.0290			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	118	-2.45	0.0159
Satterthwaite	Unequal	100.98	-2.41	0.0179

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	50	68	1.24	0.4056

HEALTH

```
data gender;
input con gender$ health;
cards;
```

1	F	4.1
120	M	4.5

```
;proc ttest data = gender;
class gender;
var health;
run;
```

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The TTEST Procedure

Variable: Health

gender	N	Mean	Std Dev	Std Err	Minimum	Maximum
F	69	4.3601	0.4696	0.0565	3.2000	5.8000
M	51	4.4725	0.4760	0.0666	3.5000	5.7000
Diff (1-2)		-0.1124	0.4723	0.0872		

gender	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
F		4.3601	4.2473	4.4729	0.4696	0.4022	0.5642
M		4.4725	4.3387	4.6064	0.4760	0.3982	0.5916
Diff (1-2)	Pooled	-0.1124	-0.2851	0.0603	0.4723	0.4189	0.5413
Diff (1-2)	Satterthwaite	-0.1124	-0.2856	0.0608			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	118	-1.29	0.2000
Satterthwaite	Unequal	107.07	-1.29	0.2011

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	50	68	1.03	0.9078

TASTE

```
data gender;
input con gender$ taste;
cards;
 1          F          4.277778
 120        M          4.5
;proc ttest data = gender;
class gender;
var taste;
run;
```

The TTEST Procedure

Variable: taste

gender	N	Mean	Std Dev	Std Err	Minimum	Maximum
F	69	4.3994	0.5158	0.0621	2.7778	5.8889
M	51	4.5795	0.6779	0.0949	3.3333	6.5000
Diff (1-2)		-0.1802	0.5899	0.1089		

gender	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
F		4.3994	4.2755	4.5233	0.5158	0.4418	0.6198
M		4.5795	4.3889	4.7702	0.6779	0.5672	0.8427
Diff (1-2)	Pooled	-0.1802	-0.3959	0.0356	0.5899	0.5233	0.6761
Diff (1-2)	Satterthwaite	-0.1802	-0.4055	0.0452			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	118	-1.65	0.1008
Satterthwaite	Unequal	89.844	-1.59	0.1157

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	50	68	1.73	0.0361

Appendix II:

Questionnaire Ballots

Informed Consent Form to Participate in the Taste test

Faculty of Biotechnology

Assumption University

1. I, _____, agree to participate to be a panelist in this research which is being conducted by Faculty of Biotechnology at Assumption University, Bangkok, Thailand.

2. I recognize that the objective of this research is to evaluate the samples in the taste test. I will be asked the opinions by answering the questionnaire completely by my own.

3. I recognize that the results of this participation will be confidential and will not be released in any individual identifiable form without my prior consent unless required by law.

4. I recognize that I do not need to participate in this research and I can refuse the participation of this research without penalty or loss of benefits.

5. I recognize that I can withdraw my consent at any time.

6. If I have questions or problems regarding to this research, I recognize that I can address to Dr. Aussama Soontrunnarudrungsri at 10th floor Q building, Assumption University, Bangkok, Thailand (02) 300-4553 ext. 3794.

_____

Signature of Participant

_____

Date

Consumer No._____ Date:

_____

INSTRUCTION

- There are four samples in the set for you to evaluate.
- Please rinse your mouth with water before starting and between samples.
- Please taste the four samples in the order presented, from left to right.
- You may drink as much as you would like, but you must consume at least half the sample provided.
- If you have any questions, please ask now.

There are three main parts for you to evaluate as **intensity, found character note and overall liking.**

For each part, there are different evaluations that you need to be followed.

PART I: *INTENSITY*

Evaluation: Consider the sweetness and aftertaste intensity of the sample.

Please rate the intensity from 0 – 15, of how strong the sweetness and aftertaste of each sample.

0	=	non
1	=	noticeable
15	=	extremely sweet, extremely aftertaste
		(Note: 0.5 inclement is allowed.)

SAMPLE CODE _____ _____ _____

_____

➢ **Sweetness** _____ _____ _____

_____

➢ **Aftertaste** _____ _____ _____

_____

PART II: ***FOUND CHARACTER NOTE***

Evaluation: Consider the aftertaste of the sample.

Please mark ✓ in the space provided if you can notice any provided aftertaste.

For other choice, please identify any character note that you can notice.

SAMPLE CODE	_____	_____	_____
_____			
➢ **Bitterness**	_____	_____	_____
_____			
➢ **Astringent**	_____	_____	_____
_____			
Other (Please specify)	_____	_____	_____
_____			

Part III: ***OVERALL LIKING***

Evaluation: Consider overall characteristic of the sample.

Please rate the overall liking from 1 – 9 of each sample.

1 = dislike extremely 4 = dislike slightly 7 = like moderately

2 = dislike very much 5 = neither like nor dislike 8 = like very much

3 = dislike moderately 6 = like slightly 9 = like extremely

SAMPLE CODE	_____	_____	_____
_____			
Overall liking	_____	_____	_____

Part 1: Consumption Behavior Questionnaire

INSTRUCTION: Please read the question and mark ✓in the box that most apply to your opinion and behavior.

	Disagree strongly	Disagree moderately	Disagree slightly	Neither agree nor disagree	Agree slightly	Agree moderately	Agree strongly
n constantly sampling new and different ds.							
on't trust new foods.							
don't know what a food is, I won't try it.							
ike foods from different cultures.							
thnic food looks too weird to eat.							
t dinner parties, I will try new foods.							
am afraid to eat things I never have had efore.							
am very particular about the food I eat.							
will eat almost everything.							
like to try new ethnic restaurants.							
don't think much about food each day.							
Cooking or barbequing is not much fun.							
Talking about what I ate or am going to eat is omething I like to do.							
Compared with other daily decisions, my ood choices are not very important.							
When I travel, one of the things I anticipate nost is eating the food there.							
	Disagree strongly	**Disagree moderately**	**Disagree slightly**	**Neither agree nor disagree**	**Agree slightly**	**Agree moderately**	**Agree strongly**
do most or all of the clean up after eating.							
enjoy cooking for others and myself.							

en I eat out, I don't think or talk much ut how the food tastes.							
not like to mix or chop food.							
most or all my own food shopping.							
not wash dishes or clean the table.							
re whether or not a table is nicely set.							
n very particular about the healthiness of d.							
ways follow a healthy and balanced diet.							
s important to me that my diet is low in .							
is important to me that my daily diet ntains a lot of vitamin and mineral.							
eat what I like and I do not worry about the ealthiness of food.							
do not avoid any foods, even if they may ise my cholesterol.							
	Disagree strongly	**Disagree moderately**	**Disagree slightly**	**Neither agree nor disagree**	**Agree slightly**	**Agree moderately**	**Agree strongly**
The healthiness of food has little impact on ny food choices.							
The healthiness of snacks makes no lifference to me.							
n my opinion, the use of light products does ot improve one's problem.							
do not think that light products are healthier han conventional products.							
believe that eating light products keep one's holesterol level under control.							
n my opinion light products don't help to lrop cholesterol levels.							

lieve that eating light products keeps 's body in good shape.							
ıy opinion by eating light products one eat more without getting too much ories.							
not care about additives in my daily diet.							
ny opinion, organically grown foods are better for my health than those grown ventionally.							
ny opinion, artificially flavored foods are harmful to my health.							
	Disagree strongly	**Disagree moderately**	**Disagree slightly**	**Neither agree nor disagree**	**Agree slightly**	**Agree moderately**	**Agree strongly**
ry to eat foods that do not contain ldditives.							
would like to eat only organically grown egetables.							
do not eat processed foods, because I do not now what they contain.							
n my opinion it is strange that some people ıave cravings for chocolate.							
n my opinion it is strange that some people ıave cravings for sweet.							
n my opinion it is strange that some people ıave cravings for ice cream.							
often have cravings for sweets.							
often have cravings for chocolate.							
often have cravings for ice cream.							
reward myself by buying something really ısty.							
indulge myself by buying something really							

cious.							
en I am feeling down I want to treat self with something really delicious.							
	Disagree strongly	**Disagree moderately**	**Disagree slightly**	**Neither agree nor disagree**	**Agree slightly**	**Agree moderately**	**Agree strongly**
oid rewarding myself with food.							
ny opinion, comforting oneself by eating elf-deception.							
y to avoid eating delicious foods when I feeling down.							
o not believe that food should always be a urce of pleasure.							
ne appearance of food makes no difference r me.							
is important to me to eat delicious foods on eekdays as well as the weekend.							
hen I eat, I concentrate on enjoying the ste of food.							
finish my meal even when I do not like the aste of food.							
An essential part of my weekend is eating elicious food.							

Part 2: Demographic Information Questionnaire

Instruction: Please mark ✓ in the box below which is related to your information.

1. What is your gender?

☐ Male ☐ Female

2. What is your age?

☐ Less than 18 years ☐ 18-25 years ☐ 26-35 years

☐ 36-45 years ☐ 46-55 years ☐ Over 55 years

3. What is the highest education you have attained?

☐ Junior High School Certificate or under

☐ High School Certificate

☐ Vocational Certificate

☐ Higher Vocational Certificate

☐ Bachelor's Degree

☐ Higher than Bachelor's Degree

4. What is your occupation?

☐ Student

☐ Self-employed / Business owner

☐ Private employee

☐ Government employee / State enterprise employee

☐ Other_____

5. What is your work/study field?

☐ Business

☐ Architecture

☐ Communication Arts

☐ Science and Technology

☐ Engineers

☐ Laws

☐ Arts

☐ Other_____

6. What is your average monthly household income?

☐ Below 10,000 Baht ☐ 10,000-20,000 Baht ☐ 20,001-30,000 Baht

☐ 30,001-40,000 Baht ☐ 40,001-50,000 Baht ☐ above 50,000 Baht

แบบฟอร์มแสดงการยินยอมเข้าร่วมการทดสอบ

คณะเทคโนโลยีชีวภาพ

มหาวิทยาลัยอัสสัมชัญ

.1ข้าพเจ้า (เขียนตัวบรรจง(_____ยินยอมเข้าร่วมเป็น , ผู้ทดลอบในการวิจัยของคณะเทคโนโลยีชีวภาพ มหาวิทยาลัยอัสสัมชัญกรุงเทพมหานคร ประเทศไทย ,

2. ข้าพเจ้าตระหนักว่าวัตถุประสงค์ของโครงการวิจัยนี้คือเพื่อประเมินตัวอย่าง ในการทดสอบรสชาติ

ข้าพเจ้าจะถูกถามความคิดเห็นโดยการตอบแบบสอบถามด้วยตัวข้าพเจ้าเองให้เสร็จสมบูรณ์

3.ข้าพเจ้าตระหนักว่าผลการปฏิบัติงานของข้าพเจ้าในโครงการวิจัยนี้จะถูกเก็บและใช้เป็นข้อมูลในการวิจัย และจะไม่มีความสัมพันธ์หรือเกี่ยวโยงถึงข้าพเจ้ามากไปกว่าการชี้บ่งชื่อ ดังนั้นจึงเป็นการประกันว่าผลการทดสอบและการตอบสนองใดๆ จะถือ เป็นความลับ

4. ข้าพเจ้าตระหนักว่าข้าพเจ้าไม่จำเป็นต้องเข้าร่วมการวิจัยนี้และสามารถเลือกที่จะไม่เข้าร่วมการทดสอบโดย

ไม่มีการลงโทษ

5. ข้าพเจ้าตระหนักว่าข้าพเจ้าสามารถที่จะถอนตัวจากการวิจัยเมื่อไรก็ได้

6. ถ้าข้าพเจ้ามีข้อสงสัยเกี่ยวกับการวิจัยนี้ ข้าพเจ้าตระหนักว่าข้าพเจ้าสามารถติดต่อ ดรอุศมา สุนทรนฤรังษี ที่.อยู่ ชั้น 10 อาคาร Q มหาวิทยาลัยอัสสัมชัญ , กรุงเทพมหานคร ประเทศไทย หมายเลขโทรศัพท์(02) 300-4553 ต่อ 3794

_____

(ลายเซ็น)

_____

(วันที่)

รหัสผู้ทดสอบ..... วันที่.....

คำแนะนำแก่ผู้ทดสอบ

- ผู้ทดสอบจะได้รับตัวอย่างเครื่องดื่มจำนวน 4 ตัวอย่างที่ให้รหัสแล้วชุดหนึ่ง
- ให้ทำการล้างปากด้วยน้ำก่อนทำการทดสอบ และระหว่างการทดสอบจากตัวอย่างหนึ่งไปอีกตัวอย่างหนึ่งทุกครั้ง
- โปรดทดสอบและทำการประเมินตัวอย่างตามลำดับที่นำเสนอ จาก ซ้าย ไป ขวา
- ผู้ทดสอบสามารถชิมได้ตามปริมาณที่ต้องการ แต่ปริมาณที่ชิมต้องเกินครึ่งหนึ่งของปริมาณทั้งหมดในแต่ละตัวอย่าง
- หากผู้ทดสอบมีข้อสงสัยหรือต้องการความช่วยเหลือใดๆ สามารถถามได้
- แบบทดสอบนี้แบ่งการประเมินออกเป็น 3 ส่วน ได้แก่ **ความเข้มข้น (Intensity), ลักษณะที่ปรากฏของรสชาติที่ตกค้าง (Found character note),** และ **ความชอบโดยรวม (Overall liking)**
- ในแต่ละส่วน ลักษณะการประเมินผลจะแตกต่างกันไป โดยผู้ทดสอบจะต้องปฏิบัติตาม

ส่วนที่ 1: ความเข้มข้น (Intensity)

การประเมิน: โปรดพิจารณาระดับความหวาน และ ระดับของรสชาติที่ตกค้างในแต่ละตัวอย่าง

โปรดประเมินระดับความเข้มข้นว่ามากน้อยเพียงใดของความหวานและรสชาติที่ตกค้าง จาก 0 - 15

0	=	ไม่รับรู้รส)non)
1	=	เริ่มรับรู้)noticeable(
15	=	หวานมากสุด, รสชาติตกค้างมากสุด (อนุญาตให้ใช้ 0.5)

รหัสตัวอย่าง: _____ _____ _____ _____

➢ **ความหวาน (Sweetness)** _____ _____ _____ _____

➢ **รสชาติที่ตกค้าง (Aftertaste)** _____ _____ _____ _____

ส่วนที่ 2: ลักษณะที่ปรากฏของรสชาติที่ตกค้าง (Found character note)

การประเมิน: โปรดพิจารณารสชาติที่ตกค้างของแต่ละตัวอย่าง

โปรดทำเครื่องหมาย ✓ ในส่วนของรสชาติที่ตกค้างที่กำหนดให้หากผู้ทดสอบสามารถรับรู้ได้

หากมีรสชาติที่ตกค้างนอกเหนือจากที่กำหนด ผู้ทดสอบสามารถระบุในช่องว่างที่กำหนดไว้

รหัสตัวอย่าง:	_____	_____	_____	_____
➢ **รสขม)Bitterness)**	_____	_____	_____	_____
➢ **รสเฝื่อน)Astringent)**	_____	_____	_____	_____
➢ **อื่นๆ (โปรดระบุ)**	_____	_____	_____	_____

ส่วนที่ 3: ความชอบโดยรวม (Overall liking)

การประเมิน: โปรดให้คะแนนระดับความชอบโดยรวมของแต่ละตัวอย่างจากคะแนน 1 - 9

1 = ไม่ชอบเลย 4 = ไม่ชอบเล็กน้อย 7 = ชอบปานกลาง

2 = ไม่ชอบมาก 5 = เฉยๆ 8 = ชอบมาก

3 = ไม่ชอบปานกลาง 6 = ชอบเล็กน้อย 9 = ชอบมากเป็นพิเศษ

รหัสตัวอย่าง:	_____	_____	_____	_____
ความชอบโดยรวม	_____	_____	_____	

ตอนที่ 1 **แบบสอบถามความคิดเห็นเกี่ยวกับพฤติกรรมการบริโภคอาหาร**

คำชี้แจง กรุณาอ่านข้อความในแต่ละข้อ แล้วทำเครื่องหมาย ✓ ในช่องที่ใกล้เคียงกับความคิดเห็นและพฤติกรรมของคุณ

		ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	ไม่ค่อยเห็นด้วย	เฉย ๆ	ค่อนข้างเห็นด้วย	เห็นด้วย	เห็นด้วยอย่างยิ่ง
	คุณลองอาหารใหม่และแตกต่างเป็นประจำ							
	คุณไม่ไว้ใจผลิตภัณฑ์อาหารใหม่							
	หากคุณไม่รู้จักอาหารประเภทใด คุณจะไม่ลองรับประทานอาหารประเภทนั้น							
	คุณชอบอาหารที่มาจากหลายๆ วัฒนธรรมที่แตกต่าง							
5	อาหารต่างชาติดูแปลกเกินกว่าที่จะรับประทาน							
6	คุณจะลองรับประทานอาหารใหม่ในงานเลี้ยงสังสรรค์							
7	คุณกลัวที่จะลองรับประทานอาหารที่คุณไม่เคยรับประทานมาก่อน							
8	คุณเจาะจงกับอาหารแต่ละชนิดที่คุณรับประทานอย่างมาก							
9	คุณรับประทานอาหารเกือบทุกประเภท							
10	คุณชอบที่จะลองไปร้านอาหารต่างชาติ							
11	ในแต่ละวัน คุณไม่ได้คิดเกี่ยวกับอาหารมากนัก							
12	การทำอาหารไม่ใช่เรื่องสนุก							
		ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	ไม่ค่อยเห็นด้วย	เฉย ๆ	ค่อนข้างเห็นด้วย	เห็นด้วย	เห็นด้วยอย่างยิ่ง
13	คุณชอบที่จะพูดถึงอาหารที่คุณรับประทาน หรือ อาหารที่คุณกำลังจะรับประทาน							

	อาหารที่คุณตัดสินใจเลือกรับประทานไม่สำคัญเมื่อเปรียบเทียบกับเรื่องอื่นที่คุณต้องตัดสินใจในแต่ละวัน							
	เมื่อคุณเดินทางการรับประทานอาหาร ณ ที่แห่งนั้น เป็นเรื่องหนึ่งที่คุณจดจ่อรอคอยมากที่สุด							
	คุณมักจะเป็นคนรับผิดชอบทำความสะอาดทั้งหมดหรือเกือบทั้งหมดหลังจากรับประทานอาหารเสร็จ							
	คุณสนุกกับการทำอาหารสำหรับคุณเองและคนอื่นๆ							
8	เมื่อคุณรับประทานอาหารนอกบ้าน คุณไม่คิดหรือพูดถึงรสชาติของอาหาร							
9	คุณไม่ชอบที่จะผสมหรือสับหรือหั่นอาหาร							
0	คุณเป็นคนรับผิดชอบซื้ออาหารสำหรับตัวคุณเองทั้งหมด หรือเกือบทั้งหมด							
1	คุณไม่ล้างจาน หรือ ทำความสะอาดโต๊ะอาหาร							
2	คุณให้ความสำคัญกับโต๊ะอาหารว่า โต๊ะอาหารนั้นถูกจัดอย่างดีหรือไม่							
		ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	ไม่ค่อยเห็นด้วย	เฉย ๆ	ค่อนข้างเห็นด้วย	เห็นด้วย	เห็นด้วยอย่างยิ่ง
23	คุณเจาะจงเกี่ยวกับอาหารเพื่อสุขภาพอย่างมาก							
24	คุณปฏิบัติตามการรับประทานอาหารที่สมดุลและเพื่อสุขภาพอย่างสม่ำเสมอ							
25	การรับประทานอาหารที่มีไขมันต่ำเป็นเรื่องที่สำคัญมากสำหรับคุณ							
26	การรับประทานอาหารที่มีวิตามินและเกลือแร่สูงในแต่ละวันเป็นเรื่องที่							

	สำคัญสำหรับคุณ							
	คุณรับประทานอาหารที่คุณชอบและไม่กังวลเกี่ยวกับอาหารว่าอาหารนั้นดีต่อสุขภาพหรือไม่							
	คุณไม่หลีกเลี่ยงอาหารประเภทใดเลย ถึงแม้ว่าอาหารประเภทนั้นจะทำให้คลอเรสเตอรอลของคุณสูงขึ้น							
	อาหารเพื่อสุขภาพมีผลน้อยมากเกี่ยวกับการตัดสินใจเกี่ยวกับอาหารของคุณ							
0	คุณเห็นว่าอาหารว่างเพื่อสุขภาพแตกต่างจากอาหารว่างทั่วไป							
		ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	ไม่ค่อยเห็นด้วย	เฉย ๆ	ค่อนข้างเห็นด้วย	เห็นด้วย	เห็นด้วยอย่างยิ่ง
1	ในความเห็นของคุณ การรับประทานผลิตภัณฑ์อาหารประเภทพลังงานต่ำหรือไขมันต่ำไม่ช่วยให้ปัญหาสุขภาพดีขึ้น							
2	คุณไม่คิดว่าผลิตภัณฑ์อาหารประเภทพลังงานต่ำหรือไขมันต่ำดีต่อสุขภาพมากกว่าผลิตภัณฑ์อาหารทั่วไป							
3	คุณเชื่อว่าการรับประทานผลิตภัณฑ์อาหารประเภทพลังงานต่ำหรือไขมันต่ำช่วยควบคุมระดับคลอเรสเตอรอล							
4	ในความเห็นของคุณ ผลิตภัณฑ์อาหารประเภทพลังงานต่ำหรือไขมันต่ำไม่ช่วยลดระดับคลอเลสเตอรอล							
5	คุณเชื่อว่ารับประทานอาหารประเภทพลังงานต่ำหรือไขมันต่ำช่วยให้ร่างกายอยู่ในสภาพที่ดี							
6	ในความเห็นของคุณ หากรับประทานอาหารประเภทพลังงานต่ำหรือ							

	ไขมันต่ำ คุณสามารถรับประทานอาหารนั้นได้มากขึ้นโดยไม่ทำให้ร่างกายรับพลังงานมากเกินไป							
	คุณไม่ให้ความสำคัญเกี่ยวกับสารปรุงแต่งที่เติมในอาหารที่คุณรับประทาน							
	ในความเห็นของคุณ อาหารที่ปลูกแบบอินทรีย์ไม่ได้ดีกว่าอาหารที่ผ่านการปลูกแบบปกติ							
	ในความเห็นของคุณ อาหารที่มีส่วนผสมของสารแต่งกลิ่นรสสังเคราะห์ไม่มีอันตรายต่อสุขภาพ							
		ไม่เห็นด้วยอย่างยิ่ง	**ไม่เห็นด้วย**	**ไม่ค่อยเห็นด้วย**	**เฉย ๆ**	**ค่อนข้างเห็นด้วย**	**เห็นด้วย**	**เห็นด้วยอย่างยิ่ง**
0	คุณพยายามรับประทานอาหารที่ไม่มีสารปรุงแต่ง							
1	คุณต้องการที่จะรับประทานผักที่ปลูกแบบอินทรีย์เท่านั้น							
2	คุณไม่รับประทานอาหารที่ผ่านการแปรรูป เพราะคุณไม่ทราบว่ามีอะไรในอาหารนั้น							
3	ในความเห็นของคุณ เป็นเรื่องแปลกที่บางคนมีความอยากที่จะรับประทานช็อคโกแลต							
4	ในความเห็นของคุณ เป็นเรื่องแปลกที่บางคนมีความอยากที่จะรับประทานของหวาน							
5	ในความเห็นของคุณ เป็นเรื่องแปลกที่บางคนมีความอยากที่จะรับประทานไอศครีม							
6	คุณมีความอยากที่จะรับประทานขนมหวานอยู่บ่อยๆ							

	คุณมีความอยากที่จะรับประทานช็อกโกแลตอยู่บ่อยๆ							
	คุณมีความอยากที่จะรับประทานไอศครีมอยู่บ่อยๆ							
	คุณให้รางวัลกับตัวคุณเองโดยการซื้ออาหารที่มีรสชาติดีมากๆ							
	คุณมักตามใจตัวเองโดยการซื้ออาหารอร่อยๆ							
		ไม่เห็นด้วยอย่างยิ่ง	**ไม่เห็นด้วย**	**ไม่ค่อยเห็นด้วย**	**เฉย ๆ**	**ค่อนข้างเห็นด้วย**	**เห็นด้วย**	**เห็นด้วยอย่างยิ่ง**
1	เมื่อคุณรู้สึกแย่ คุณต้องการที่จะช่วยให้ตัวคุณรู้สึกดีขึ้นโดยการรับประทานอาหารอร่อยๆ							
2	คุณพยายามหลีกเลี่ยงที่จะให้รางวัลตัวเองด้วยอาหาร							
3	ในความเห็นของคุณ การรับประทานอาหารเพื่อให้รู้สึกดีขึ้นเมื่อคุณรู้สึกหดหู่เป็นการหลอกตัวเอง							
4	คุณพยายามหลีกเลี่ยงอาหารที่อร่อยเมื่อคุณรู้สึกแย่							
55	คุณไม่เชื่อว่าอาหารเป็นสิ่งที่ให้ความสุขเสมอไป							
56	ลักษณะที่ปรากฏของอาหารไม่มีผลกับคุณ							
57	การรับประทานอาหารที่อร่อยระหว่างวันทำงานเช่นเดียวกับอาหารที่คุณรับประทานในวันเสาร์อาทิตย์เป็นเรื่องสำคัญสำหรับคุณ							
58	คุณใส่ใจกับความเพลิดเพลินในรสชาติที่คุณได้รับเมื่อคุณรับประทานอาหารนั้นๆ							
59	คุณรับประทานอาหารทั้งจาน ถึงแม้ว่าคุณจะไม่ชอบรสชาติของอาหารนั้น							
60	ส่วนสำคัญของวันหยุดของคุณคือการได้รับประทานอาหารอร่อยๆ							

ตอนที่ 2 ข้อมูลสถานภาพทั่วไปของผู้ตอบแบบสอบถาม

คำชี้แจง กรุณาใส่เครื่องหมาย ✓ ลงใน ☐หน้าคำตอบที่ตรงกับสภาพความเป็นจริงและ

กรุณากรอกรายละเอียดลงในช่องว่างที่กำหนดถ้าเลือกตัวเลือกข้อนั้นๆ

1. เพศ

☐ ชาย หญิง ☐

2. อายุ

☐ ต่ำกว่า 18 ปี ☐ 18-25 ปี ☐ 26-35 ปี

☐ 36-45 ปี ☐ 46-55 ปี ☐ 55 ปีขึ้นไป

3. ระดับการศึกษาสูงสุด

☐ ระดับมัธยมศึกษาตอนต้น (ม.3 (หรือต่ำกว่า

☐ ระดับมัธยมศึกษาตอนปลาย ม).6(

☐ ระดับประกาศนียบัตรวิชาชีพ (.ปวช)

☐ ระดับประกาศนียบัตรวิชาชีพชั้นสูง (.ปวส)

☐ ระดับปริญญาตรี

☐ สูงกว่าระดับปริญญาตรี

4. อาชีพ

☐ นักเรียน นักศึกษา / ☐ ค้าขาย ธุรกิจส่วนตัว /

☐ ลูกจ้างเอกชน พนักงานบริษัท / ☐ ข้าราชการ รัฐวิสาหกิจ /

☐ อื่นๆ (โปรดระบุ)_____☐

☐

5. สาขาวิชาที่เรียน / ลักษณะงาน ☐

☐ บริหารธุรกิจ การจัดการ / สถาปัตย์ ☐ นิเทศศาสตร์

☐ วิทยาศาสตร์และเทคโนโลยี ☐ วิศวกรรม ☐ กฎหมาย

☐ ศิลปศาสตร์ อื่นๆ (โปรดระบุ)_____

6. รายได้เฉลี่ยต่อเดือน

☐ น้อยกว่า 10,000 บาท ☐ 10,000-20,000 บาท ☐ 20,001-30,000 บาท

☐ 30,001-40,000 บาท ☐ 40,001-50,000 บาท ☐ 50,000 บาท ขึ้นไป

***** ขอขอบพระคุณค่ะ *****