This practical training report is submitted for the partial requirement for Bachelor Degree

By:
Lorentia Santoso
12.70.0078

DEPARTMENT OF FOOD TECHNOLOGY
FACULTY OF AGRICULTURAL TECHNOLOGY
SOEGIJAPRANATA CATHOLIC UNIVERSITY
SEMARANG

2015
CONSUMER PERCEPTION ON SINGLE AND MIXES TASTE SOLUTION

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PREFACE

Gratitude belongs only to the Almighty One, who has given His affection and blessing to the author for taking the time to complete this practical training report entitled “Consumer Perception on Single and Mixes Taste Solution”. This practical training report is submitted to fulfill one of the requirements to gain bachelor degree of Agricultural Technology Faculty, Food Technology Department, Soegijapranata Catholic University.

In finishing this report, the writer really gives regards and thanks for people who has given guidance and help; they are:
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Finally, the writer realizes that there are unintended errors in writing this report. The writer really allows all readers to give suggestions to improve its content in order to be made as one of the good examples for the next practical training. Big hope from the writer that this report can be useful for others.

Writer
CONTENTS

TITLE ..........................................................................................................................  i
APPROVAL PAGE.....................................................................................................  ii
PREFACE ....................................................................................................................  iii
CONTENTS.................................................................................................................  iv
LIST OF TABLES .......................................................................................................  v
LIST OF FIGURES .....................................................................................................  vi
1. INTRODUCTION ................................................................................................  1
  1.1. Institution Profile ............................................................................................  1
  1.2. Purpose of Practical Training ........................................................................  4
  1.3. Time and Place of Practical Training .............................................................  4
  1.4. Background of Internship Program ...............................................................  4
  1.5. Research Overview .........................................................................................  5
    1.5.1. Background of Research .......................................................................  5
    1.5.2. Aim .......................................................................................................  8
    1.5.3. Objectives .............................................................................................  8
    1.5.4. Literature Review .................................................................................  8
2. RESEARCH METHODOLOGY .........................................................................  15
  2.1. Materials .........................................................................................................  15
  2.2. Statistic tools ...................................................................................................  15
  2.3. Methods ..........................................................................................................  15
    2.3.1. Formulating the Samples of Matching Test .........................................  15
    2.3.2. Formulating the Samples of Rating Test ..............................................  15
    2.3.3. Recruiting Consumer ............................................................................  17
    2.3.4. Consumer Test ......................................................................................  17
3. RESULT AND DISCUSSION .............................................................................  18
  3.1. Demographic Data ..........................................................................................  18
  3.2. Sensory Evaluation ........................................................................................  19
  3.3. Consumer Perception Between Male and Female Consumers .......................  20
  3.4. Consumer Perception Between a Single and Mixed Sweet Solution .............  21
  3.5. Consumer Perception Between on Single and Mixed Sour Solution .............  22
  3.6. Rating Test Information of Consumers ..........................................................  23
4. CONCLUSION .....................................................................................................  24
5. RECOMENDATION ............................................................................................  24
6. REFERENCES ........................................................................................................... 25
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The Formulation of Samples</td>
<td>16</td>
</tr>
<tr>
<td>2</td>
<td>Demographic Data</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>Matching Test</td>
<td>19</td>
</tr>
<tr>
<td>4</td>
<td>Rating Test</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>Analysis of Gender on Taste Perception</td>
<td>21</td>
</tr>
<tr>
<td>6</td>
<td>Single and Mixed Sweet Solution (Matching Test)</td>
<td>22</td>
</tr>
<tr>
<td>7</td>
<td>Single and Mixed Sweet Solution (Rating Test)</td>
<td>22</td>
</tr>
<tr>
<td>8</td>
<td>Single and Mixed Sour Solution (Matching Test)</td>
<td>22</td>
</tr>
<tr>
<td>9</td>
<td>Single and Mixed Sour Solution (Rating Test)</td>
<td>23</td>
</tr>
<tr>
<td>10</td>
<td>One Sample T-Test Of Single and Mixed Sweet Solution</td>
<td>23</td>
</tr>
<tr>
<td>11</td>
<td>One Sample T-Test Of Single and Mixed Sour Solution</td>
<td>23</td>
</tr>
</tbody>
</table>
LIST OF FIGURES

Figure 1 Logo of Assumption University of Thailand ......................................................... 1
Figure 2 Logo of Biotechnology Faculty ........................................................................ 2
Figure 3 Map of Assumption University, Hua Mak, Bangkok ....................................... 4
Figure 4 One set of Sample ....................................................................................... 17
Figure 5 Consumer Test for Single Solution .................................................................. 17
Figure 3 Consumer Test for Mixed Solution .................................................................. 17
1. INTRODUCTION

1.1. Institution Profile

1.1.1. Assumption University (AU)

AU has been providing education to the youth of Thailand and other nations since 1969. The university employs English as the official instruction and has formal links and cooperation agreements with a large network of international institutions of higher learning for scholastic exchange and research programs. The university is administered by the Montfort Brothers of St. Gabriel, a worldwide Catholic Religious Order devoted to education and philanthropic activities. The Congregation operates 15 educational institutions in Thailand. Recently, AU has three campuses located in Hua Mak, Central World Plaza, and Suvarnabhumi areas of Bangkok, Thailand.

AU offers many kind of majors, such as Engineering, Information Technology, Science, Nursing, Law, Business Administration, Communication Art, Architecture, Biotechnology, and Music. Assumption University is the first international university in Thailand. As the international university, AU is noted for attracting large number of foreign students from many countries. The university has a student body of about 19,870 including a fairly large complement of foreign students drawn from 75 countries of the world including Russia, China, Burma, India, Bangladesh, Pakistan, and other Asian countries. Not only Asian countries, there are also exchange students from the United States (Loyola) and Europe. It also has a high caliber faculty, a truly international community of scholars and professionals representing diverse academic disciplines, different fields of business, and many government organs. These arrangements help considerably in bringing students into close touch with pragmatic aspects of life.

Figure 1. Logo of Assumption University of Thailand
1.1.2. Faculty of Biotechnology

The Faculty of Biotechnology was founded in 1993 as the ninth faculty of Assumption University. This faculty has been growing to produce graduates working in biotechnology field and it related fields. The faculty has been offering four classes of 4 years bachelor’s programs in Agro fields, Biotechnology, Food Biotechnology, Agro Industry, and in Food Technology. The objective of this faculty is to provide the nation with highly trained professional who are able to implement the scientific principles to the continuous improvement of the safe, quality and value biotechnological services and products. The majorities of Thai people are involved in agriculture and related industries. Knowledge in biotechnology has a big impact because can be directly implied to the utilization of agricultural products to increase the value.

Figure 2. Logo of Biotechnology Faculty

1.1.3. Vision

To be the leading international biotechnology school developing human resources and expanding and transferring knowledge for continuous improvement of the safety, quality and value of agricultural and food products through the excelling in the creation of new knowledge and application in Biotechnology appropriated for development of the country/community.

1.1.4. Mission

- Providing exemplary educational opportunities that will prepare students to contribute to a dynamic, diverse and global society and pursue lifelong learning;
- Use the best-suited scientific tools and systems to solve both fundamental and applied scientific questions pertaining to agro-industry and food science;
- Improve competitiveness and profitability of growers and processors of fruit and vegetable crops, animals, and other expanding agro industries;
- Develop and implement food biotechnologies to ensure the wholesomeness of foods;
• Improving individual, family and community well-being through the discovery and dissemination of knowledge in the agricultural, food systems, life and environmental sciences;

• Providing knowledge in the biological, physical and social sciences necessary to optimize the profitability, sustainability and productivity of the country’s agricultural resources while fostering stewardship of natural and human resources;

• Help create, attract, and retain agricultural, food, and biotechnology enterprises between international countries.

• Addressing the role of the Assumption University in enhancing and developing student and industry interactions as a viable part of the global economy.

1.1.5. Strategic Goals

• Students are competent human resources who responsibly contribute to a dynamic and diverse society and appreciate different cultures.

• Students and faculty members are able to create, transfer and expand knowledge through research development in biotechnology, food technology and agro-industry to solve problems pertaining agriculture and food science for a well-being of the country.

• Faculty members and students are able to transfer knowledge and technology through academic services for a well being of the country.

1.1.6. Faculty Members

1.1.6.1. Administrators

The main administrators of the faculty are in follow:

• Dr. Churdchai Cheowtirakul as Dean and Director of Ph.D. program in Food Biotechnology

• Dr. Viyada Kunathigan as Director of MS Program in Food Biotechnology

• Dr. Aussama Soontrunnarudrungsri as Chairperson of Department of Food Technology

• Dr. Prathip Chiaravanond as Associate Dean and Chairperson of Department of Agro-Industry
1.1.6.2. Instructors
In academic year 2005, the Faculty of Biotechnology has 19 full-time instructors, three teaching assistants, one administrative staff and two laboratory technicians. The faculty also invited 14 part-time qualified instructors to teach the students from 1st year to 4th year. Academic ratios of the full-time instructors and part time instructor in 2004 are as follows.
- Full time instructor Ph.D.: MS : BS  = 3:13:3
- Part time instructor Ph.D.: MS : BS  = 5:8:0

1.2. Purpose of Practical Training
- To give the student an experience to deal with food research, so that the student can implement the knowledge that they learned in the real industrial or scientific world.
- To give the student an opportunity to adapt with new culture and society.
- To broaden the student’s knowledge and experience from the international exposure.

1.3. Time and Place of Practical Training
The practical training is performed at the Faculty of Biotechnology, Assumption University Hua Mak Campus, Bangkok, Thailand, in 16th January to 26th March 2015.

![Figure 3. Map of Assumption University, Hua Mak, Bangkok](image)
The red indicator shows the location of Assumption University Hua Mak which is located in ABAC (Ramkhamhaeng 24), Assumption University, Hua Mak, Bangkok 10240, Thailand (Telephone : +66 2 300 4543).

1.4. Background of Internship Program
Food is one of three primary needs of human life besides clothing and place to live. In its role as a primary need, food have role to supply energy and nutritional value which are human needs
to live. Simply said, people can’t live without any food. Nowadays, the demand for food is not only on a delicious food for supplying energy and nutritional value to human being but also having safety factor. Besides the primary demand, as the development of science and technology, the demand for food becoming more complex and diverse like simplicity of serving, good taste, good appearance, proper packaging, and more importantly, the ability to promote health. Therefore, food technology has very important role for answering the changing demand of food products which always increasing day by day.

Because of that there is a need to conduct the practical training for students from Food Technology Department, Soegijapranata Catholic University. The students of food technology are obliged to do an internship program or practical training in food industry during their study to improve their knowledge about food technology. This program has a purpose to expose the students with the food-related research or the experience in real world practice of food industry and experience in order to face the opportunities and challenges in food technology development.

Faculty of Biotechnology, Assumption University, Thailand, was chosen as the practical training workplace because this faculty has an advanced field of biotechnology and microbiology. This internship program also gives the opportunity for food technology students to do research abroad, and for experiencing cultural diversity as global citizen. This opportunity can be achieved, because of the internship program between the Soegijapranata Catholic University and Assumption University.

1.5. Research Overview
The main topic of the research is “Consumer Perception on Single and Mixes Taste Solution”. The advisor of this research is Dr. Aussama Soontrunnarudrungsri. The main goal of this research is to explore the differences of consumer perception on single solution and mixed solution, and to investigate perceived intensity of sweetness and sourness in single and mixed solution.

1.5.1. Background of Research
It is estimated that 75% of new products fail within their first year on the supermarket shelf and that, as a consequence, considerable resource invested in product development is wasted (Kemp et al., 2009). Sensory attributes are key determinations of product delivery including
quality, functional and emotional benefits. Thus, a considerable proportion of product failure can be attributed to a mismatch between sensory properties and consumer needs or expectations. When integrated within the product development process, sensory and consumer testing allows cost effective delivery of acceptable products to consumers and thus reduces the risk of failure (Lawless and Heymann, 1998).

In the early stages of product development, consumer and sensory testing can help identifying the important sensory attributes. It can identify sensory based target consumer segments, analyze competitor products, and evaluate new concepts. Sensory and consumer testing is widely employed in the research arena. It is used at a more fundamental level to investigate new technologies to aid product development and to understand consumer behavior (Kemp et al., 2009).

Unlike instruments, human perception can easily be affected by psychological or physiological factors. There are perceptual interactions between stimuli that can interact to cause enhancement, synergy, and suppression. The presence of one substance increases the perceived intensity of another, the intensity of a mixed is greater than the intensity of the sum of the individual components, the presence of one substance decreases the perceived intensity of another (Kemp et al., 2009). Human perceptions of food and consumer products are resulted from complex sensory and interpretation processes. At this stage in scientific history, perceptions of such multidimensional stimuli as conducted by the parallel processing of the human nervous system are difficult or impossible to predict from instrumental measures (Meilgaard et al., 1991).

Nowadays people are looking for sweet taste beverages, which is provides a pleasant feeling. The impact of consumer perception on sweetness will be explored in a single and mixed model taste solutions using sour and flavor at certain concentrations. When two or more substances of qualitatively different taste are mixed, the overall perceived taste intensity of the mixed is, in most cases, less than the sum of intensities of unmixed components. This phenomenon, called mixed suppression, is the result of a decrease of the specific taste intensities (sweetness, sourness, saltiness, bitterness) contributing to the overall intensity of the solution (Schiffstein and Jan, 1991). Moreover, there is an impact of olfactory perception on sweetness in a model solution using odorants at certain concentration. The sweetness of sucrose solution can be enhanced by certain levels of an odorant (Labbe et al., 2007).
Perceptual interactions between stimuli can be one of the physiological factors affecting sensory measurements. Certain stimuli can interact to cause the enhancement, synergy, and suppression. The enhancement phenomenon caused by the presence of one substance which can increase the perceived intensity of another. Certain stimuli can make the synergy during sensory measurement, the intensity of mixture is greater than the intensity of the sum of the individual components, e.g, sweetness and sourness impact on strawberry flavour. Then suppression means the presence of one substance decreases the perceived intensity of another (Kemp et al., 2009). The purpose of this study is to introduce the interaction between sweet taste, sour taste, and orange flavour either in single taste solution or mixed taste solution.

In order to account for the numerous interactions between the senses of taste and smell, McBurney (1986) proposed that a distinction ought to be drawn between two types of flavor perception, namely synthetic and analytic. Analytic perception occurs when two stimuli mixed in a solution keep their individual qualities of sensation. By contrast, synthetic perception occurs when two stimuli that have been mixed in a solution loose their individual qualities in order to form a new (third) sensation. The different smell and taste components of a flavor are not combined synthetically to form a new sensation (where the smell and taste components would loose their individual qualities of sensation), but rather they are combined in order to form a single percept. This explains why the components of a flavor are perceived as a whole but still remain analyzeable when people specifically attend to each component. During the rating phase, the phenomenon of sweetness enhancement seems to be crucially dependent on the particular strategies used by the participants when responding in such experiments. For example, Frank et al. (1993) have shown that the sweetness enhancement of a sucrose solution that can be elected by adding strawberry odor only occurs when the participants are asked to rate sweetness (and nothing else). However when they were asked to judge other qualities, such as saltiness, sourness, and bitterness, the sweetness enhancement effect disappears. Similar findings have also been reported by Clark and Lawless (1994). These authors observed significantly less sweetness enhancement in their study when their participants were asked to rate in mixed solutions than when they were asked to rate only the sweetness of the single solutions. Van der Klaauw and Frank (1996) subsequently argued that when participants are required to individually evaluate the different components of a flavor, the phenomenon of sweetness enhancement may well disappear.
Two main approaches are used for consumer testing: matching test and rating test (Lawless and Heyman, 2010). Those two methods are the discrimination test. Discrimination tests are testing samples for their differences from each others. Difference tests can be used to test the sensitivity of judges as well as to perform a practical function such as determining whether a food company should buy an inexpensive ingredient to replace a more expensive one in formulating a food product. The two types of difference tests are overall difference tests and attribute difference tests (Meilgaard et al., 2007). Therefore, this study was undertaken to explore how consumer perception on single and mixed taste solution. These consumer tests used sucrose solution as a single sweet solution and the combination between sweet, sour, and odorants. This study evaluated the differences of taste attributes related to sweetness level on single or mixed solution.

1.5.2. Aim
The aim of this study is to determine how consumers perceive single and mixed taste solution.

1.5.3. Objectives
The main objectives of this study are:
1. To explore the differences of consumer perception on single sweet solution and mixed sweet solution.
2. To explore the differences of consumer perception on single sour solution and mixed sour solution.
3. To explore the difference responses of male and female consumers for single and mixed taste solution.

1.5.4. Literature Review
1.5.4.1. Sensory Evaluation
Sensory evaluation is a scientific discipline used to evoke, measure, analyze and interpret those responses to products that are perceived by the senses of sight, smell, touch, taste and hearing. In a food company, sensory scientists work closely with product developer to understand what consumers like and why to change an ingredient of products. In academia, sensory scientists try to understand how consumer senses work and how consumer senses respond to stimuli (both from food and chemicals). Sensory evaluation is used to reduce uncertainty and risks in decision making, to ensure a cost efficient delivery of new products with high consumer
acceptability, beside that human observers are good measuring instruments. People can detect odorants at levels lower than what can be detected by an instrument (Stone and Sidel, 1993).

Sensory evaluation task completes with a personal history and experiential frame of reference. Sensory experience is interpreted, given meaning within the frame of reference, and evaluated relative to expectation, and can involve integration of multiple simultaneous or sequential inputs. Finally, judgements are rendered as data. Thus, there is a chain of perception rather than simply stimulus and responses (Meilgaard et al., 1991). Only human sensory data provide the best models for how consumers are likely to perceive and react to food products in real life. Sensory data are collected, analyzed, and interpreted to form predictions about how products have changed during a product development program. Ingredient changes arise for a number of reasons. They may be introduced to improve product quality or to reduce cost of production, or introduced simply because a certain supply of raw materials has become unavailable (Lawless and Heyman, 1998).

The sensory test is conducted to study how these product manipulations will create perceived changes to human observers. In this sense, sensory evaluation is in the best traditions of psychophysics, the oldest branch on scientific psychology, which attempts to specify the relationships between different energy levels impinging on the sensory organs and the human response. Some literatures have illuminated fact that human panelists are not identical, interchangeable measuring instruments. Each comes with different physiological equipment, different frames of reference, difference abilities to focus and maintain attention, and different motivational resources. It should not be surprising that some olfactory characteristics are difficult for even trained panelists to evaluate and to agree on (Bett and Johnson, 1996).

1.5.4.2. The Effect of Color and Gender on Basic Taste Perception
Color and odor have the ability in modifying specific taste qualities (Frank et al., 1989). Certain color can evoke a strong response on the basic taste (sweet, salty, sour, and bitter) or flavoring were examined by Gifford et al. (1987). A majority of studies published that there was a relationship between color and sweetness, although color impacts on all basic taste has also been evaluated. Maga (1974) conducted a study to determine if color had an impact on basic taste thresholds. Gifford et al. (1987) published the enhancement between solutions with increasing concentrations of sodium chloride (salt), citric acid (sour), caffeine (bitter), and sucrose (sweet) were evaluated colored red, green, yellow, or colorless. Gender differences in
sensitivity to sucrose was reported by Meiselman and Dzendolet (1967), which found greater female and male performance on perceiving the sweetness.

1.5.4.3. Mixed Suppression

The feature of taste function is the tendency for mixture of different tastes to show partially inhibitory or masking interactions. Thus, a solution of citric acid and and sucrose is less sweet than an equal concentration of sucrose tasted alone. Similarly, the mixed is less sour than citric acid tasted alone. The general pattern is commonly called mixed suppression (McBurney and Bartoshuk, 1973). In many foods, these interactions are important in determining the overall appeal of the flavors and how they are balanced. For example, in fruit beverages and wines, the sourness of acids can be partially masked by sweetness from sugar. The sugar thus serves a dual role adding its own pleasant taste while decreasing the intensity of what could be an objectionable level of sourness (Lawless, 1977). Addition of even small sub-threshold amounts in mixeds will produce strong taste sensations (Yamaguchi, 1967). There seems to be strongly interactive binding enhancement at taste receptors that could be the physiological reason for this effect (Cagan, 1981).

Another set of experiment on sweetness enhancement has provided strong support for the ability of odors to modify taste qualities. When sweet odors, which in themselves posses no taste, are added as flavorings to solutions that participants have to taste, they tend to increase the perceived sweetness of those solution (Frank and Byram, 1988). For example, when caramel odor is added to a sucrose solution, the taste of the resulting mixture is perceived as being sweeter than the pure sucrose solution when presented by itself. Conversely, adding a caramel odor has also been shown to suppress the sourness of solutions containing citric acid (Stevenson et al., 1999). The reverse phenomenon, sweetness suppression, has also been documented. For example, certain odors such as angelica oil, have been reported to reduce the perceived sweetness of a sucrose solution to which they have been added as a flavoring (Stevenson et al., 1999). The odors that typically sweet tastes appear to be related to previous instances of co-exposure with a sweet taste such as might naturally occur during eating (Presscott, 2004). For example, the odors of vanilla, caramel, strawberry, and mint induce sweetness enhancement in western countries where people often experience those odors with sucrose. On the other hand, non-western participants do not describe some of these odors as sweet, probably due to a less frequent pairing of theses odors with sweetness in their food culture (Nguyen et al., 2002). It should be noted that such sweetness enhancement and
suppression effect cannot be accounted for simply in terms of chemical interactions between the odors and taste present in the solution, because the effect can be abolished simply by pinching the participant’s nose (Schifferstein and Verlegh, 1996). Furthermore, the same odors are typically reported as being tasteless when they are experienced alone in solution (Prescott, 2004). Pfeiffer et al. (2006) found that while the sucrose and acid presented in the solution played a critical role in the intensity perception of strawberry flavor.

Suppression or partial masking of sourness regularly occurs in complex food systems. It is well known that sweeteners constitute one of the most effective masking agents for sourness. Sweeteners are combined in the formulations of acidified foods to achieve optimum taste, while maintaining the desired pH. However, the most effective sweet masker for a particular acid and the optimal level or range of the masker, given the acid concentration, are usually ascertained by a trial and error approach. Mixed interactions have been variously examined in the literature, involving interactions between sweet and sour between citric acid and sucrose have primarily been used. Suprathreshold levels of citric acid have been shown to suppress sucrose sweetness (Pangborn, 1961). Sucrose was reported to suppress the perceived intensity of citric acid (McBride, 1989; McBride & Johnson, 1987). Schifferstein and Frijters (1991) reported that kind of sweeteners like aspartame, saccharin, fructose, and sucrose were effective in suppressing the perceived sourness of citric acid, whereas McBride and Finlay (1990) found that sucrose suppressed the perceived sourness intensity of citric acid more effectively than did fructose. Mutually suppressing interactions between citric acid and the sucrose revealed that there was a greater suppression of sweetness by acid levels than of sourness by increasing sweetener levels (Bonnans & Noble, 1993).

The phenomenon of taste suppression in general, depends on three main factors: the type of suppressing taste substance, the physical intensity of the suppressing component, and the relative number of components that make up the mixture (Kroeze, 1989). With respect to the physical intensity of the suppressing component, it has not been clearly established whether the weight, the molarity, or the perceived intensity of the suppressor is a significant determinant of the resulting suppression. The aim in this study was to better understand the consumer perception on sweet and sour mixed solution either in single solution or with flavor added. On the other hand, a correspondence with perceived sugar sweetness would be indicative of neural effects (central/peripheral). Although the idea that suppression in sweet and sour mixed is a
A perceptual phenomenon related to the perceived intensity of the masking agent has been explored (Schifferstein & Frijters, 1991).

1.5.4.4. Sensory Interactions

An enduring puzzle in the perception of flavor has been the question of how taste and smell interact. The perception of flavor is a synthesis of taste and smell impressions, along with effects of texture and temperature, and is even influenced by appearance. Von Sydow et al. (1974) examined ratings for taste and odor attributes in fruit juices that varied in added sucrose. Ratings for pleasant odor attributes increased and those for unpleasant odor attributes decreased as sucrose concentration increased. Sucrose also suppressed harsh taste such as bitterness, sourness, and astringency. Suppression of other taste components would be expected through simple mechanisms of mixed suppression. A similar effect was found for blackberry juice flavor in varying levels of sucrose and acidity (Perng and McDaniel, 1989). Sucrose enhanced fruit flavor ratings, while juice with high acid level showed lower fruit ratings. The other observation is that interactions change with various taste/flavor combinations. The pattern is potentially complicated by the ways in which interactions may depend on the particular flavorants and tastants that are combined. Aspartame enhanced fruitiness of orange and strawberry solutions but had little or no effect on sucrose, and a somewhat greater enhancement occurred for orange than for strawberry (Wiseman and McDaniel, 1989). In similar study, sweetness was enhanced by strawberry odor, but not by peanut butter odor (Frank and Byram, 1988). Any flavor chemical placed in the nose or mouth is likely to have multiple sensory effect.

One important reason for the rapid growth of research interest on the topic of flavor perception in recent years stems from the light in that gaining a better understanding of how the multisensory integration taking place in the context of food perception might shed on theories of multisensory integration in general. On the other hand, it is also widely believed that the study of multisensory processes involved in flavor perception will have a number of important consequences for the food and beverage industries, such as, for example, a better understanding of the processes used by people to assess the acceptability and flavor of new products (Auvray and Spence, 2007). A series of experiments showing in the interactions between the senses of smell and taste are based on the detection threshold of odor and taste compounds. Dalton, Doolittle, Nagata, and Breslin (2002) found that for certain combinations of stimuli, a sub-threshold concentration of an odor compound is more easily detected when presented together.
in conjunction with a sub-threshold concentration of a taste compound than when it is presented alone.

1.5.4.5. Scaling Method

The method of scaling involve the application of numbers to quantify sensory experience. It is through this process of numerification that sensory evaluation becomes a quantitative science subject to statistical analysis, modeling, prediction, and hard theory. Three common methods have been used for scaling in sensory evaluation. Perhaps the oldest and most widely used scaling method is category rating where panelists assign numerical values to the perceived sensations based on specific and limited responses. At the other extreme is the method of magnitude estimation, which allows panelists to assign any numbers they wish to reflect the ratios between sensations. The third popular method is that of line marking, where the panelist makes a mark along a line to indicate the strength of sensation or degree of liking. These methods differ along two important dimensions. The first is the degree of freedom allowed the panelist and constraint placed on the allowable responses. An open-ended scale (one without an upper boundary) has the advantage of allowing the panelists the freedom to choose any numerical response that seems appropriate. However, responses are difficult to calibrate across panelists, if that is desired. Data coding, analysis, and interpretation can be complicated. Simple category ratings, on the other hand, are easier to assign to fixed intensity anchors or reference standard, facilitating calibration of panelists, and data coding and analysis is usually straightforward. The second dimension of difference among scaling methods is the degree of differentiation allowed the panelist. Panelists may have the freedom to use as may intermediate points along the scale as seems necessary, as opposed to being limited to discrete options (Lawless and Malone, 1986).

In nominal scaling, numbers are assigned to event merely as labels. The appropriate analysis of such data is to make frequency counts and report the mode. The mode is the most frequent response, and it is used as a summary statistic for nominal data. In ordinal scaling, numbers are assigned to recognize the rank order of products with regard to some sensory property, attitude, or opinion. In this case, increasing numbers assigned to the products represent increasing amounts or intensities of sensory experience how consumer perceive sweetness or sourness. Consumer panels typically require a larger number of panelists. Consumer panelists can be screened on a test criteria, for example, demographics or potential use of product. The questions asked of consumer panels should be answerable by untrained panelists. Manufactures,
scientists, food technologist, and marketers can use consumer panels to gain a clear perception of what ordinary consumers may experience when tasting a particular food item (Lawless and Malone, 1986).

1.5.4.6. Sensory Methods

Attribute difference taste tests focus on a single sensory attribute such as sweetness or sourness. Attribute tests often are administered to evaluate qualitative differences in taste, color, and texture. The paired comparison test is a test of difference in which a specific characteristic is designated. Rating difference test is the test to differentiate among multiple samples that uses a rating scale. Products are ranked using a rating scale to assess for differences between samples. Matching test are used to determine a panelist’s ability to discriminate differences among several stimuli presented at intensities well above threshold level. Familiarize panelists with an initial set of four to six coded, but unidentified products. Then present a randomly numbered set of eight to ten samples, of which a subset is identical to the initial set. Ask panelists to identify on the scoresheet the familiar samples in the second set and to label them with corresponding codes from first set. Rating test for intensity is used to determine panelist’s ability to discriminate graded levels of intensity of a given attribute. Present a series of samples in random order, in which one parameter is present at different levels, which cover the range present in the products of interest. Ask panelists to rank the samples in ascending order or rate them using the prescribed scale according to the level of stated attribute (sweetness, sourness, oiliness, stiffness, surface smoothness, etc).
2. RESEARCH METHODOLOGY

2.1. Materials
Water, Sugar (Savepak Brand), Citric Acid (Ajax Vinechem Pty Ltd), Lexicon Tangerin Flavor (Firmenich Ltd), Orange Food Colorant (Winners, Thailand) Ltd.

2.2. Statistical Analysis
SPSS (Statistical Package for the Social Sciences) program version 13 to find out the significance of differences between samples in single and mixed taste solution with matching and rating test. The method used was Parametric Test (One Sample t-test, Independent Samples t-test, Paired Samples t-test) and Non-Parametric Test (2 Independent Samples and 2 Related Samples).

2.3. Methods
2.3.1. Formulating the Samples of Matching Test
For sweetness intensity panelists were given six samples, one was labelled as the sample and five were labelled with three digit code as references. Three digit coded samples consist of 8% of sucrose solution, 9% of sucrose solution, 10% of sucrose solution, 11% of sucrose solution, and 12% of sucrose solution. For sourness intensity panelists were given five samples, one was labelled as the sample and four were labelled with three digit code as references. Three digit coded samples consist of 0.025% of citric acid solution, 0.05% of citric acid solution, 0.08% of citric acid solution, 0.1% of citric acid solution.

2.3.1.1. Single Taste Solution
The sample was prepared by dissolving 100g of sucrose and 0.8g of citric acid in 1000 ml of water then stirred.

2.3.1.2. Mixed Taste Solution
The sample was prepared by dissolving 100g of sucrose and 0.8g of citric acid in 1000 ml of water then 0.05% of flavor and 0.1% of food colorant were added, then stirred.

2.3.2. Formulating The Samples of Rating Test
For sweetness intensity panelists were given six samples, one was labelled with three digit code as blind sample and five were labelled with certain intensity as references. Intensity consist of
8 for sweetness, 9 for sweetness, 10 for sweetness, 11 for sweetness, and 12 for sweetness. For sourness intensity panelists were given five samples, one was labelled with three digit code as blind sample and four were labelled with certain intensity as references. Intensity consist of 2.5 for sourness, 3.5 for sourness, 5 for sourness, and 7 for sourness.

2.3.2.1. Single Taste Solution
Blind sample was prepared by dissolving 100g of sucrose and 0.8g of citric acid in 1000 ml of water then stirred.

2.3.2.2. Mixed Taste Solution
Blind sample was prepared by dissolving 100g of sucrose and 0.8g of citric acid in 1000 ml of water then 0.05% of flavor and 0.1% of food colorant were added, then stirred.

The samples of about 10 ml each were given to 100 fixed consumers to taste and each consumer had to taste 2 kind of sensory test. Matching test, consumer should match which one among three digit coded reference samples was most similar with the sample for sweetness and sourness intensity. Rating test, consumer should rate the sweetness and sourness intensity of blind sample compared with reference samples were labelled with certain intensity from 0-15.

The data was collected by filling out a questionnaire and all the samples were served using room temperature (35-37°C). Water was used in each test to be a palate cleanser. The consumers did not know the formulation of the samples to prevent bias and the cups were given 3 digit codes randomly. The above procedures were repeated with single and mixed taste solution. Formulation of samples can be shown in Table 1 below.

<table>
<thead>
<tr>
<th>Table 1. The Formulation of The Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample/Reference</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Sample</td>
</tr>
<tr>
<td>1. Water Based</td>
</tr>
<tr>
<td>2. Mixed Based</td>
</tr>
<tr>
<td>Reference</td>
</tr>
<tr>
<td>1. 8% of Sucrose</td>
</tr>
<tr>
<td>2. 9% of Sucrose</td>
</tr>
<tr>
<td>3. 10% of Sucrose</td>
</tr>
<tr>
<td>4. 11% of Sucrose</td>
</tr>
<tr>
<td>5. 12% of Sucrose</td>
</tr>
<tr>
<td>6. 0.025% of Citric Acid</td>
</tr>
<tr>
<td>7. 0.05% of Citric Acid</td>
</tr>
<tr>
<td>8. 0.08% of Citric Acid</td>
</tr>
<tr>
<td>9. 0.1% of Citric Acid</td>
</tr>
</tbody>
</table>
2.3.3. Recruiting Consumer
Consumers who participated in the study were screened in order to have balanced number of male and female consumer. The total of the consumer participated in the sensory test was 100 fixed consumers. The screener was conducted at Assumption University, Hua Mak campus and adjacent areas. There were 100 fixed panelists with the same panelists for each test.

2.3.4. Consumer Test
The test were conducted in Assumption University, Hua Mak Campus. Consumers, who had been screened before, asked to taste and evaluate the samples. They were also asked to fill out a questionnaire about their demographic data (gender, age, and occupation). They had to evaluate and express their perception on sweet and sour attributes using matching and rating test. The order of the samples given was randomized so consumer would have no idea what is the first or second sample they evaluated, and the bias could be minimized. The randomization method used is the Williams square design. The results were analyzed statistically using SPSS (Statistical Package for the Social Sciences) version 13.
3. RESULT AND DISCUSSION

The sense of taste is one of the most important human senses. The way consumers perceive the food in terms of taste is a very important aspect in food technology. Alteration in taste perception is crucial because it influences dietary habits and general health. This perception is influenced by many things including culture, background and taste sensitivity. This study will evaluate about how consumer perception on single and mixed solution. Mixed interactions have been variously examined in some literature, involving interactions between sweet and sour between citric acid and sucrose have primarily been used. The phenomenon of taste suppression in general, depends on some factors including the type of suppressing taste substance and the physical intensity of the suppressing component. Not a lot of research has been done about the perception on mixed solution consist of sweet taste, sour taste, orange tangerine flavor, and orange colorant however many journals are available on sensory interaction and other flavors used. In this research, we will find out about the effect of orange flavor and orange color on the consumer’s perceived sweetness and sourness intensity of mixed solutions. We will know there difference perception between male and female consumer and how consumer perception between matching test and rating test.

3.1. Demographic Data

The result of consumer test is also affected by consumer’s background, culture, and all of their demographic data. It is important to know how background of consumers influence the taste perception. This study also explores the difference responses of male and female consumers for single and mixed taste solution. The background of consumers have to be considered to reduce bias. There are two main factors that can result bias, psychological and physiological factor.

Table 2. Demographic Data

<table>
<thead>
<tr>
<th>No.</th>
<th>General Information</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>56</td>
</tr>
<tr>
<td>2</td>
<td>Age</td>
<td></td>
</tr>
<tr>
<td></td>
<td>18 – 22 years</td>
<td>62</td>
</tr>
<tr>
<td></td>
<td>23 – 35 years</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>36 – 45 years</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Over 45 years</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>Occupation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Undergraduate Student</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>Graduate Student</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>PhD Student</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Employee</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Self Employ</td>
<td>2</td>
</tr>
</tbody>
</table>
For gender, there were almost balance for male and female. It was a total of 100 consumers, 44 of which were male and 56 were female as it showed in Table 2. Therefore, one of objectives in this study is to explore how gender influence the sensory results. From the sensory test which involve 100 consumers, mostly are in age between 18-22 years old. The consumers in age between 23-35 is in the next position. The third, there is population in age over 45 years old. There are only 6 people or 6% of consumers who are between 36-45 years old. The consumers have different occupations. From 100 consumers in sensory test, 71% among them are undergraduate student. Others, there are 10% graduate student, 12% employee, 5% PhD student and 2% self-employ. This study is mainly done around Assumption University, therefore for the age distribution and education, the majority of consumers were mainly is students.

3.2. Sensory Evaluation
Besides demographic data, in the consumer test held there are 2 sensory test. The sensory test was held using matching test and rating test. The result was evaluated using SPSS Version 13.00.

3.2.1. General Information
How consumer perception on single and mixed taste solution can be showed in matching test and rating test result. Through matching test, we can know the percentage of each intensity from consumers’s answer. Then for rating test result can showed us about mean, median, and mode.

Table 3. Matching Test

<table>
<thead>
<tr>
<th>Sample Solution</th>
<th>Attribute</th>
<th>Intensity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Solution</td>
<td>Sweetness</td>
<td>8</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Sourness</td>
<td>2.5</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.5</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7</td>
<td>19</td>
</tr>
<tr>
<td>Mixed Solution</td>
<td>Sweetness</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12</td>
<td>20</td>
</tr>
</tbody>
</table>
According to Table 3 above, in single sweet solution the highest percentage of intensity is 10 of sweetness and then in single sour solution 32% among 100 consumers gave 3.5 of sourness for the answer. Based on McBurney and Bartoshuk (1973) a solution of citric acid and and sucrose is less sweet than an equal concentration of sucrose tasted alone. Similarly, the mixed is less sour than citric acid tasted alone. The result showed that by adding sucrose into citric acid solution, the intensity of sourness can be decreased. But, the mixed suppression was not happen in single sweet solution, we can see from Table 3 that citric acid added into sucrose solution was not give a significantly changes in sweetness intensity. From this result, suppressing interactions between citric acid and the sucrose revealed that there was a greater suppression of sourness by sweet levels than of suppression of sweetness by increasing acid levels. The sugar serves a role in decreasing the intensity of sourness (Lawless, 1977). In mixed solution, orange flavor have a significant contribution in sweetness and sourness intensity. Orange flavor can be both of sweet and sour enhancement in taste solutions.

### Table 4. Rating Test

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Solution Type</th>
<th>Mean ± SD</th>
<th>Median</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweetness</td>
<td>Single Solution</td>
<td>8.59 ± 2.99</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Mixed Solution</td>
<td>9.29 ± 2.36</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Sourness</td>
<td>Single Solution</td>
<td>5.05 ± 2.13</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Mixed Solution</td>
<td>5.68 ± 2.33</td>
<td>5.5</td>
<td>8</td>
</tr>
</tbody>
</table>

Both of sweetness and sourness intensity of mixed solution, based on the result above has higher intensity than single sweet and sour solution. It means that orange flavor can increased consumers’s perception on sweetness and sourness. From this result, suppressing interactions between citric acid and the sucrose revealed that there was a greater suppression of sweetness by acid levels than of suppression of sourness by increasing sweet levels.

**3.3. Consumer Perception Between Male and Female Consumers**

Balance number between male and female consumers can be used to determine the influence of gender differentiation on taste perception. Gender has been found to influence liking, attitude, affective response, choice, and perception toward food (Nu et al., 1996). Another study found that with respect to pure fruits and vegetables, girls yield higher affective
responses, while boys tend to rate those products higher when sugar is added (Mielby et al., 2012). When evaluating cake products, men gave higher liking scores than women; it would thus seem that both boys and men have tendencies to rate sweeter foods higher, perhaps due to girls and women paying more attention to whether the product is healthy or not (Michon et al., 2010). However, although women have been found to rate healthy meals higher than males regarding pleasure and convenience (Rappoport et al., 1993) in comparing comfort foods, men generally favor hot meals (steak, casserole, soup, etc.), while women generally favor snack foods (chocolate, ice cream, etc.). It has been shown that women are more likely to have foods rejections, and yet seem to be more willing than men to try new or novel foods (Wansik et al., 2003). One study suggested that gender difference may be due to women focusing more on their senses and the actual sensation they experience, while men may be focusing more on any cognitive information they receive about the product (Beardsworth et al., 2002).

Table 5. Analysis of Gender on Taste Perception

<table>
<thead>
<tr>
<th>Sample Solution</th>
<th>Attribute</th>
<th>Gender</th>
<th>Mean ± SD</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Solution</td>
<td>Sweetness</td>
<td>Male</td>
<td>8.99 ± 2.92</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>8.26 ± 3.03</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Sourness</td>
<td>Male</td>
<td>4.92 ± 1.95</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>5.15 ± 2.28</td>
<td>-</td>
</tr>
<tr>
<td>Mixed Solution</td>
<td>Sweetness</td>
<td>Male</td>
<td>10.02 ± 1.84</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>8.71 ± 2.56</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Sourness</td>
<td>Male</td>
<td>5.67 ± 2.12</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Female</td>
<td>5.69 ± 2.50</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: - means samples in the attribute are not significantly different.

The result of consumer test for both solutions show that means of sweetness intensity for male consumer are higher than female consumer in both of sample solution type. But, the sweetness intensity is not significantly different between male and female consumers. In sour taste there is no significantly difference between male and female consumers. From these studies, there was no definite differences between males and females when it comes to single and mixed solutions. However, the variety of product categories researched in this study was limited, meaning this study examined typically only specific attribute, research regarding gender differences across a wide variety of product categories would therefore be a useful contribution to the current literature.

3.4. Consumer Perception on Single Sweet Solution and Mixed Sweet Solution
Comparison between single sweet solution and mixed sweet solution can be showed in Table 6 and Table 7 below. There tables can showed us how effect of flavor and color on sweetness level.

![Table 6. Single and Mixed Solution (Matching Test)]

<table>
<thead>
<tr>
<th>Ranks</th>
<th>Intensity</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative Ranks</td>
<td>Single Sweet &lt; Mixed Sweet</td>
<td>31</td>
</tr>
<tr>
<td>Positive Ranks</td>
<td>Single Sweet &gt; Mixed Sweet</td>
<td>56</td>
</tr>
<tr>
<td>Ties</td>
<td>Single Sweet = Mixed Sweet</td>
<td>13</td>
</tr>
</tbody>
</table>

From Table 6 above, mostly of consumers have a higher intensity of sweetness on single solution than mixed solution. More than 50% of consumers (87%) have a different perception between single and mixed solutions. 56% of consumers met a phenomenon of mixed suppression, but in this case sweetness suppression by acid level and acid flavor was greater than sourness suppression by sweet level. There was a sweetness suppression, orange flavor (tangerine) has been reported to reduce the perceived sweetness of a sucrose solution to which they have been added as a flavoring.

![Table 7. Single and Mixed Solution (Rating Test)]

<table>
<thead>
<tr>
<th>Sample Solution</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Solution</td>
<td>8.59 ± 2.99^a</td>
</tr>
<tr>
<td>Mixed Solution</td>
<td>9.29 ± 2.36^b</td>
</tr>
</tbody>
</table>

Note: Means with the same letter in a row are not significantly different.

According to Table 7, mixed solution have a greater intensity based on mean score. It means that flavor and colorant adding can enhance sweetness level of solution. Between single solution and mixed solution there was a significant differences. Matching test result has a different interpretation with rating test result. For matching test panelists gave a response to the perceived sensations based on specific and limited responses. At the other hand, rating test allows panelists to assign any numbers they wish to reflect the ratios between sensations or larger scale to response the test (Lawless and Malone, 1986).

3.5. Consumer Perception on Single Sour Solution and Mixed Sour Solution

Comparison between single sour solution and mixed sour solution can be showed in Table 8 and Table 9 below. There tables can showed us how effect of flavor and color on sourness level.

![Table 8. Single and Mixed Solution (Matching Test)]
Table 9. Single and Mixed Solution (Rating Test)

<table>
<thead>
<tr>
<th>Ranks</th>
<th>Intensity</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative Ranks</td>
<td>Single Sour &gt; Mixed Sour</td>
<td>29</td>
</tr>
<tr>
<td>Positive Ranks</td>
<td>Single Sour &lt; Mixed Sour</td>
<td>60</td>
</tr>
<tr>
<td>Ties</td>
<td>Single Sour = Mixed Sour</td>
<td>11</td>
</tr>
</tbody>
</table>

Note: Means with the same letter in a row are not significantly different.

Table 8 shows us that 60% of consumers perceived a stronger intensity when flavor and colorant added. According to Table 9, mixed solution has a greater mean score than single solution. Level of sourness between single and mixed solution was significantly different. In this study, orange flavor induce sourness enhancement in mixed solution. The odors that typically sour tastes appear to be related to previous instances of co-exposure with a sour taste such as might naturally occur during eating (Presscott, 2004).

3.6. Rating Test Information of Consumers
In this part, we can know how final answer of rating test information for 100 consumers. The result of rating test show which intensity look significant for sweetness and sourness level. This part is used to compare one group’s average value to a single number (each intensity of sweetness and sourness).

Table 10. One Sample T-Test of Single and Mixed Sweet Solution

<table>
<thead>
<tr>
<th>Intensity of Sweetness</th>
<th>Single Sweet Solution</th>
<th>Mixed Sweet Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>1.96*</td>
<td>5.47*</td>
</tr>
<tr>
<td>9</td>
<td>-1.39</td>
<td>1.23</td>
</tr>
<tr>
<td>10</td>
<td>-4.73*</td>
<td>-3.01*</td>
</tr>
<tr>
<td>11</td>
<td>-8.08*</td>
<td>-7.25*</td>
</tr>
<tr>
<td>12</td>
<td>-11.43*</td>
<td>-11.49*</td>
</tr>
</tbody>
</table>

Table 11. One Sample T-Test of Single and Mixed Sour Solution

<table>
<thead>
<tr>
<th>Value</th>
<th>Single Sour Solution</th>
<th>Mixed Sour Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5</td>
<td>11.96*</td>
<td>13.64*</td>
</tr>
<tr>
<td>3.5</td>
<td>7.27*</td>
<td>9.35*</td>
</tr>
<tr>
<td>5</td>
<td>0.23</td>
<td>2.91*</td>
</tr>
<tr>
<td>5.5</td>
<td>-2.11*</td>
<td>0.77</td>
</tr>
<tr>
<td>7</td>
<td>-9.14*</td>
<td>-5.66*</td>
</tr>
</tbody>
</table>

Table 10 shows us that there was no significant differences for sweetness level on 9 of sweetness intensity. It means that from 100 consumers’s answer, the intensity of sweetness on
single and mixed solution is 9. Then for sour solution, we can see from Table 11, there was no significant differences in 5 of sour intensity (single solution) and 5.5 of sour intensity (mixed solution). Flavor and colorant can increase the intensity of sourness.

4. CONCLUSION

Although there was no significant differences between male and female consumers in way to perceive taste. It is of interest to note that studies reporting gender differences in sensitivity to sweet and sour taste generally require a decision based on quality recognition. But we can conclude that there was a different consumer perception between single solution and mixed solution that can still be perceived by consumers. When it compares with flavor and colorant adding, we can see that consumer perceived different sweet and sour intensity of sample containing sucrose and citric acid. There was a significant differences in consumer perception, either for sweet taste or sour taste. In mixed solution, orange (tangerine) flavor induce sourness enhancement and create a phenomenon of mixed suppression, it means sweetness suppression by acid taste and acid flavor level. Demographic data has an effect on the consumer behavior results like the age of consumers. The sensory professional needs to be aware that cultural effects can have an impact on sensory data.

5. RECOMMENDATION

It would be better if this research can be developed with different sweeteners and different flavors. So the objectives of this research are to explore how consumer perceive the sweetness if we make some formulations with different sweeteners and flavors. The phenomenon of mixture suppression can be analyzed to know the effect of flavors on sweetness. Beside that, the panelist for this research can be added and also can compare between how trained panelist perceive the taste and how untrained panelist perceive the taste. If want to explore is there any differences between male and female in perceiving the taste, it is better if we can have panelist in balance number for each gender.
6. REFERENCES


