The Development of Riceberry Pudding for People with Dysphagia

Ms. Nwe Nwe Win

ID. 6019702

Thesis Submitted in Partial Fulfillment of the Requirement for the Degree of Master of Science in Food Biotechnology

Department of Food Technology

Assumption University Thailand

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By: Miss Nwe Nwe Win

ID: 6019702

Advisor: Asst. Prof. Dr. Patchanee Yasurin

Co-Advisor: Asst. Prof. Dr. Malinee Sriariyanun

Co-Advisor: Dr. Aussama Soontrunnarudrungsri

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(Asst. Prof. Dr. Patchanee Yasurin)
Thesis Advisor

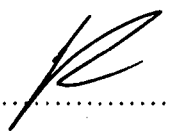
.....

(Asst. Prof. Dr. Malinee Sriariyanun)
Thesis Co-Advisor

.....

(Dr. Aussama Soontrunnarudrungsri)
Thesis Co-Advisor

The manuscript has read and in satisfaction of the thesis requirements for the Master of Science in Food Biotechnology



..... Date.....

Patchanee Yasurin, Ph.D.

..... Date.....

Malinee Sriariyanun, Ph.D.

..... Date.....

Aussama Soontrunnarudrungsri, Ph.D.

..... Date.....

Suvaluk Asavasanti, Ph.D.

..... Date.....

Wunwisa Kasaekoopt, Ph.D.

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Ms. Nwe Nwe Win

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Abstract

The aim of this research paper is to show the development of food product for people with dysphagia and to improve the life quality for people with dysphagia using by formulating pudding-liked texture riceberry. Due to the riceberry chemical composition of amylose and amylopectin could result the acceptable range of viscosity according to National Diet Task Force (2002) and nutritional value. As the consideration of texture of food and nutrition value for people with dysphagia is crucial. Riceberry pudding was prepared by grinding riceberry, cooked in water and the addition of chicken breast and spinach for chicken formula. Mushroom formula was prepared by cooking grinded riceberry in water and added soybean and mushroom. Sensory evaluation using 9-point hedonic scale, just about right scale (JAR) ranking test and preference test, was used a tool to select optimal physical and sensorial attributes by 30 panelists with age over 50. In sensorial evaluation result showed that chicken formula 1 and mushroom formula 1 were ranked 1st and 2nd respectively and were preferred by the 30 panelists. Physical and chemical properties were determined by using viscometer and AOAC method, 2002. The viscosity at two temperature 25°C and 60°C of chicken formula 1 at was 9080 cP and 4224 cP. respectively while mushroom formula 1 has 11060 cP and 4760 cP respectively. F_0 determination was done by horizontal water spray retort however the initial loading unit of microorganism's contamination could have effect on F_0 value determination. Sterility test was used to evaluate microbiological testing of accelerated shelf life. Central location testing and home use test were used to carry out the consumer test with the number of 100 consumers . Participated individuals in this research showed the trace of presence of dysphagia but more than half of them show negative sign of hypersalivation which is excessive secretion of saliva.

Keywords: Dysphagia, Riceberry rice, pudding like, viscosity, chicken formula, mushroom formula.

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Introduction

As people age, there are physiological changes associated with aging. The global population aged 60 years or over accounted for 962 million in 2017, more than twice as large as in 1980 when there were 382 million older persons worldwide[32]. In Thailand, the speed of demographic is notable. The number of older persons is expected to grow double again by 2050, when it is projected to reach nearly 2.1 billion [26]. According to the Agency for Health Care Policy and Research (AHCPR)[35], over 60,000 Americans die from complications associated with swallowing dysfunctions. There are several cases are due to dysphagia arising from a variety of causes, primarily stroke, degenerative neurological diseases, and head and neck cancer. But swallowing difficulty can also be associated with aging[25]. In fact, it has been estimated that as many as 20% of individuals over the age of 50 years, and most individuals by the age of 80 years, experience some degree of swallowing difficulty. Dysphagia can be serious if one individual does not swallow properly[16]. Pureed foods do not need chewing. They are completely smooth with no lumps, skins, strings or seeds[16]. Pureed foods are often described as being unappealing and unrecognizable by consumers. Due to unappealing appearance of pureed foods, there is reduction of food consumption and frequently leads to malnutrition in aging population and declining in quality of life. From nutritional perspective, providing individuals with adequate amount of nutrition is challenging. Due to amylose and amylopectin of riceberry. It could achieve viscosity range that stated by National Dysphagia Diet Task Force (2002)[24].

Objectives

- To develop pudding-liked riceberry rice for people with dysphagia
- To obtain the optimal texture for pudding-liked riceberry rice.
- To improve the life quality of people with dysphagia
- To determine physical and chemical properties of the final product.
- To evaluate microbiological testing of accelerated shelf life of the final product

Literature review

Aging population in Thailand

Aging associated with physical changes in body composition. Malnutrition is very common in the elderly group (age over 70) who do not reach enough energy intake demands. Although reduction in energy intake is greatly a physiologic effect of aging (decreased energy requirement and reduced pleasure in eating) and other aspects are psychological, social, or physical problems) that becoming increasingly frequent with aging, may gravitate towards to malnutrition [12]. During the period of mid-1990s, life expectancy at birth increased from 55.2 years to 69.9 years for men and 61.8 years to 74.9 years for women. Based on the data provided by the United Nations[26], 1999, the proportion of the population in their elderly years (60+) is accounted to increase from 8.7 percent in 2000 to 10.8 percent in the year 2010, 15.2 percent in the year 2020, and 30 percent in the year 2050. The number of older persons will continue to rise, from approximately 5.3 million at present to 7.2 million in 2010 and will reach 11 million by 2020. The speed of demographic change in Thailand is remarkable[26]. The rapidity of aging population in Thailand (and some newly completed demographic transition countries) is frightening. The number of years expected to spend for shifting the proportion of the elder population from 7 percent to 14 percent is much lower in Thailand than it was in many industrialized countries. It took France almost 114 years, Sweden 85 years and Italy 63 years to grow from having 7 percent of its population in the 65 and over age group to having 14 percent in that category. In comparison, it took Japan only 26 years to make that change. But now Japan has serious competitors in Asia with Thailand and Singapore all expected to take fewer than 25 years to make the transition. The shorter time Thailand will take to become an ageing society means that the country also has a shorter time to adjust to and to plan for this rapid demographic change[26].

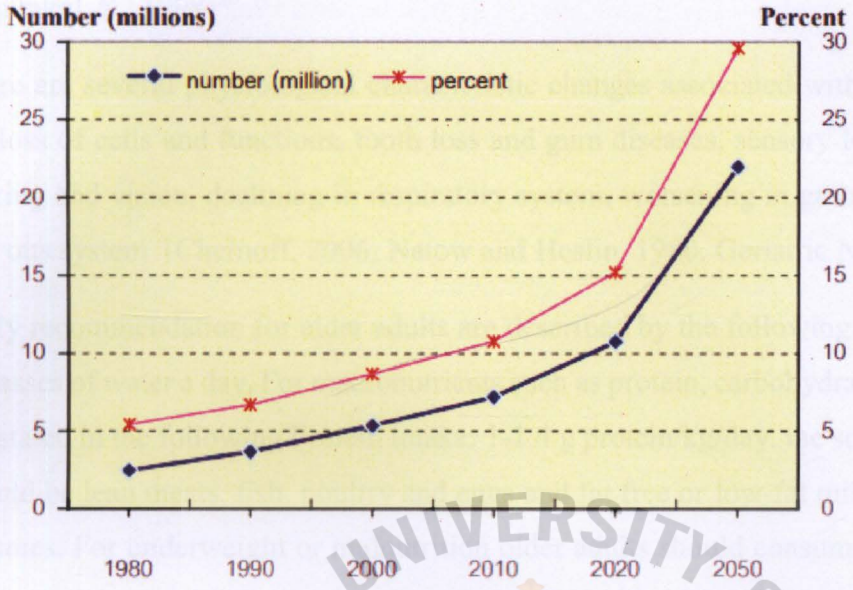


Figure 1: Percent of aging population in Thailand (Source: Calculated data provided by United Nations, 1999b)[32]

In 1994, 43.9 percent of Thai older persons had their income less than 10,000 Baht per year. The median income was 10,000-19,999 Baht. Only 11.5 percent had income over 50,000 Baht per year. The older persons in urban areas had much higher income than those in rural areas[26]. The economic condition of older women, particularly unmarried women, appears to be least favourable. Women tend to depend on children and receive more indirect support than men do. Among older persons who were employed, 65.2 percent had their income less than 2,000 Baht per month and 20.8 percent had an income ranged between 2,001-4,000 Baht per month (Phananiramai, M. and Soonthornchawakarn,N., 2002)[26]. Thirty-five percent of Thai older persons reported that their income was not adequate for themselves and their family's expenses (source: National Statistical Office, 1995)[26]. Older persons in rural areas had a higher level of income inadequacy when compared with those in urban area. Education is an important determinant of a person's health and access to resources. Approximately thirty-one percent of Thai older persons have never attended school. Thai older women have much less opportunity to formal education compared with Thai older men. Among older men and women, 71 percent and 48 percent have finished grade 4 or higher level. Older people in rural area have a lower chance for formal education than older persons in urban area. However, being educated does not guarantee the literacy of them. The

rate of no formal education is significant lower than the illiteracy rate (source: Jitapunkul, S., 1998)[26].

There are several physiological characteristic changes associated with ageing. There are loss of cells and functions, tooth loss and gum diseases, sensory losses, losses of hearing and vision, declining in respiratory system, worsening in gastrointestinal and nervous system (Chernoff, 2006; Natow and Heslin. 1980. Geriatric Nutrition).

Daily recommendation for elder adults are described by the following: water: at least 6 glasses of water a day. For macronutrients such as protein, carbohydrate, fat and fiber are stated in the following Protein intake: 1-1.4 g protein/kg/day. the source of protein should be lean meats, fish, poultry and eggs and fat free or low-fat milk products and legumes. For underweight or malnutrition older adults should consume protein dense foods such as hard-boiled, eggs, tuna fish (Chernoff, 2006. Geriatric Nutrition, the health professional's handbook). Carbohydrate and fiber intake: men need 30 g per day and women need 21 g per day. Fat intake: should consume fat in the ratio of omega 3 : omega 6 = 2:1 or 1:1, 8-10% saturated fats, 10% of polyunsaturated fatty acid (PUFA) and 15% of monounsaturated fatty acid(MUFA), and 300 mg of cholesterol per day (Source: Whitney, E.N., and Rolfes, S.R. 2005. Understanding Nutrition). For micronutrients intake such as vitamin B12: 3 mcg per day, folate intake: 400 mcg per day, vitamin D: 10 -15 mcg per day. Calcium intake: 1200-1500 mg of calcium daily (Source: Whitney, E.N., and Rolfes, S.R. 2005. Understanding Nutrition). Iron intake: should be consumed together with vitamin C rich sources for enhancing absorption.

Dysphagia

Due to advanced technology, aging population has been constantly increasing. Aging is normally associated with body composition[28]. In some cases, there is an increase in body fat specifically in individuals who fail to decrease their food intake in proportion to an age-related reduction in energy expenditure[28]. One of the diseases that occurs in aging population is dysphagia. People with dysphagia is people who have swallowing impairment, or they often lack necessary of muscular control in esophagus[7] and require puree-typed foods[11]. Changes in esophagus are often associated with aging[7]. As we age, the muscles and cartilages that we rely on for efficient swallowing also age [7].

Swallowing difficulty (dysphagia) is a common result of many medical conditions, including stroke, chronic diseases that affect the nervous system and surgeries that affect the head and neck. But swallowing difficulty can also be associated with aging[25]. In fact, it has been estimated that as many as 20% of individuals over the age of 50 years, and most individuals by the age of 80 years, experience some level of swallowing difficulty. Individuals over the age of 65 years accounted for 12.9% of the U.S. population in 2009 and are expected to account for 19% of the population by 2030. Some changes that impact swallowing with aging may be obvious, for example, missing teeth or shifting tooth positions that affect how prepared food is to be swallowed. Other changes may be less obvious, but can increase the effort required to swallow, and even interfere with the swallowing safety and effectiveness[25]

According to National Dysphagia Diet Task Force (NDDTF)[24], the texture of food of dysphagia are categorized into four levels.

1. Dysphagia pureed: homogenous, very cohesive, pudding-liked texture, and no chewing required.
2. Dysphagia mechanically altered: cohesive, moisture, semisolid foods, require chewing ability.
3. Dysphagia advanced: soft solids foods that require more chewing ability.
4. Regular : all foods are allowed.

Thicker fluids are preferable by people with dysphagia as it has cohesiveness and moves more slowly than thin fluids. These characteristics helps to protect a swallowing system that may be delayed in its response to an incoming bolus or impaired in its ability to manage bolus[8]. bolus is a small, rounded substance that associated with chewed foods when swallowing [7].

Based on the guideline of National Dysphagia Diet Task Force (2002)[24] four types of liquid viscosity are standardized.

1. Thin: viscosity of 1 to 50 centiPoise (cP)
2. Nectar-like: viscosity of 51 to 350 cP
3. Honey-like: viscosity of 351 to 1750 cP
4. Spoon-Thick: viscosity of greater than 1750 cP

Dysphagia profoundly affects quality of life: dysphagic patients experience personal discomfort and a drastic reduction in the quality of their lifestyles due to the inconvenience and pain of feeding tubes, which for many has been the primary treatment option for this condition. The loss of swallowing can also lead to severe depression due to the interruption of patients' normal ways of life [35].

Riceberry Rice

Riceberry (*Oryza Sativa*),is the new variety of rice in Thailand that is cross-breed between Thai Hom Mali 105 Rice and Hom Nin Rice by Kasetsart Univeristy, Thailand[2]. Riceberry has deep purple color and it has the characteristics of light fluffy texture, high in antioxidants, vitamin and minerals. Moreover, it contains high nutritional contents such as iron, vitamin E, β-carotene, and γ-oryzanol [11]. These nutritional properties can help in immune system, reduce risk of cancer, reduce risk of heart disease, diabetes, high blood pressure and increase blood circulation. The rice is also extremely high in fiber and its bran oil can help in digestive effective agent for neurodegeneration and memory impairment in Alzheimer's disease. Starch is distributed mostly in the endosperm's cells of brown rice. Amylose contains 8-37% of its starch amount in non-waxy rice whereas the amylopectin is the major fraction source in waxy rice. Brown rice contains a great number of celluloses approximately 62% in the bran. It is due to the exist of seed coat, aleurone layer, and thick pericarp called cell wall[4]. The amylopectin consists 25-50 % by number and 30-60 % by weight of amylose[4]. The common rice starch contains amylose:amylopectin ration roughly 20:80[36]. Cooking quality of rice is one of the important factors influencing the acceptability of consumers[31]. Cooking is the most important processing step to provide desirable texture to the rice grain. The rice grains are boiled in limited or excess amount of water during cooking. The chief constituent of rice is starch, which is made up of two major components, amylose and amylopectin. The starch of grain absorbs moisture and swells during cooking due to its gelatinization[37]. During cooking amylose leaches out from the starch granule and retrogrades when cooled, whereas amylopectin remains in the gelatinized granule. Amylose content is one of the key determinants of cooking and eating quality of rice[17]. Amylose is controlling almost all the properties

of rice starch due to its influence on thermal properties, pasting properties, syneresis, solubility, swelling and other techno-functional properties[19]. The wide varietal difference in cooking rice is mainly due to the bran layer which varies among the cultivars and provides the significant effect on the cooking properties.

Gelatinization of Rice

It is well known that starch granules have the ability to absorb water with an advancement of starch gelatinization. During the gelatinization process, starch granules have the ability absorb water not only from their surroundings but also from non-gelatinized neighbors[33]. Gelatinization of starch occurs under the presence of heat. The starch granules are dispersed in water which hardly penetrates inside the granules because of tightly packed with starch molecules. During heating the slurry, the energy destroys H bonds that hold the granules together. Once the granules are destroyed, it loses the birefringence cross. As the heating process continues, more water is absorbed in the granules and the granules swell extensively. When it reaches its highest extent then the granules degrade and release the starch molecules out. The temperature that used to heat up the starch slurry and starch slurry starts to increase the viscosity to the point where it hits the peak of viscosity which is called gelatinization temperature. In addition, starch usually gelatinizes between 68°C and 77°C. There is a phenomenon that should be concerned which is called starch retrogradation. The crystallization process in gelatinized non-waxy starch system is influenced by amylose in the early stage of gelation and by amylopectin over long-term period of storage[21,27]. The ability of starch molecules to gather and crystallize is a considerable commercial interest as it is a main factor that contributes to the textural properties of starch-based food products.

Materials and Methods

Determination of the Characteristics of Dysphagia Food

Resource ThickenUp Clear Powder is thickening agent was purchased from any local supermarket and it is designed to be used in foods and drinks for people with dysphigia as well as using as reference to obtain pudding-liked texture. According to National Dysphagia Diet Task Force (2002), the pudding-liked texture should be greater than 1,750cP by using viscometer[14]. Based on the direction of use on the packaged, 3 table spoons of Resource ThickenUp Clear Powder was used to mix with 120 ml of water to obtain pudding-liked consistency. This would be used as reference to compare with sample preparation further. Using spoon test to test the characteristics of the reference. The method is documented by Queensland Health Dietitian[3] . The characteristics of pudding-liked texture food should be holding on the spoon, no lump, smooth texture, move slowly under gravity[3].

Preliminary Study of Sample Preparation and Cooking Process

To study variable methods of sample preparation, preliminary study shall be conducted. In order to perform preliminary study, white rice (Hong Thong) and riceberry (Hong Thong) were purchased from any local stores and experimented to achieve the optimal consistency for pudding-liked texture. To prepare, partially grinded white rice and riceberry, the grinder was used to grind white rice and riceberry for 10 second without sieving. Fully grinded rice and riceberry were obtained by grinding for 30 seconds followed by sieving with 80 mesh stainless steel sifter. All the ingredients in were described in Table 1 below, were cooked by using induction stove (Induction Cooker Sharp CY101), non-stick pot for boiling and wooden spatula for stirring samples. After the sample preparation was done, the sample was filled in 250 ml canning jar and sterilized in autoclaving machine for 25 min at 121°C to observe the characteristics and compared with reference that mentioned above using spoon test.

Table 1: Preliminary Study of Sample Preparation

Method	Ingredients	Percentage of rice added	Volume(ml) of water used	Cooking time(min)
1	Whole cooked white rice	75	700	30
	Partially grinded riceberry	25		
2	Partially grinded white rice	75	1700	30
	Partially grinded riceberry	25		
3	white rice flour	75	1400	30
	Partially grinded riceberry	25		
4	riceberry flour	100	1700	30
5	Riceberry flour	100	900	30
6	Riceberry flour	100	700	30

Note: Spoon test, should use the identical material, size, and shape of spoon.

Development of Riceberry Pudding with Two Formulas; Chicken and Mushroom

Table 2: Formulation of chicken formula 1.

Ingredients	Quantity (g and ml)	Percent (%)
Ricberry flour	120 g	8.72
Chicken breast	50 g	3.63
Spinach leaves	10 g	0.73
Rice bran oil	12 g	0.87
Chicken stock seasoning	15 g	1.09
Garlic powder	15 g	1.09
White pepper	0.5 g	0.036
Total water used	1050 ml	76.25

Chicken formula 1 and spinach were blended with 200 ml of water in blender for 50 second to obtain until there was no chicken small pieces. Ricberry was grinded in grinder for 30 seconds then sieved with 80 mesh stainless steel sifter. Put riceberry into non-stick pot with 500 ml of water added, covered with the lid and heated over the induction stove (Sharp Induction Cooker CY101). Riceberry is cooked for 10 minutes and kept stirred until the temperature reaches 80°C. After 10 mins, riceberry started to gelatinize, blended chicken and spinach mixture was added to the pot and mix it well with wooden spatula. Another 100 ml of water was added slowly to riceberry to prevent it from drying out, sticking to the pan and continue cooking for 5 minutes. After 5 minutes was up, rice bran oil was added and stirred with wooden spatula followed by adding chicken stock seasoning, garlic powder and white pepper. The rest 250 ml of water was poured into the pot, mixed it well and covered with lids. Kept cooking for another 15 minutes.

Table 3: Formulation of chicken formula 2..

Ingredients	Quantity (g and ml)	Percentage(%)
Ricberry flour	120 g	7.63
Chicken breast	50 g	3.18
Spinach leaves	10 g	0.64
Rice bran oil	12 g	0.76
Chicken stock seasoning	15 g	0.95
Garlic powder	15 g	0.95
White pepper	0.5 g	0.03
Total water used	1350 ml	85.85

Chicken formula 2 and spinach were blended with 200 ml of water in blender for 50 second to obtain until there was no chicken small pieces. Ricberry was grinded in grinder for 30 seconds then sieved with 80 mesh stainless steel sifter. Put riceberry into non-stick pot with 500 ml of water added, covered with the lid and heated over the induction stove (Sharp Induction Cooker CY101). Riceberry was cooked for 10 minutes and kept stirred for 10 mins until the temperature reaches 80°C. After 10 minutes, riceberry started to gelatinize, blended chicken and spinach mixture was added to the pot and mix it well with wooden spatula. Another 100 ml of water was added slowly to riceberry to prevent it from drying out and continued cooking for 5 minutes. After 5 minutes was up, rice bran oil was added and stirred with wooden spatula followed by adding chicken stock seasoning, garlic powder and white pepper. The rest 550 ml of water was poured into the pot, mixed it well and covered with lids. Kept cooking for another 15 minutes.

Table 4: Formulation of mushroom formula 1.

Ingredients	Quantity (g and ml)	Percent (%)
Ricberry flour	120 g	9.71
Soybean	10 g	0.81
Mushroom	10 g	0.81
Rice bran oil	15 g	1.21
Mushroom stock seasoning	15 g	1.21
Garlic powder	15 g	1.21
White pepper	0.5 g	0.04
Total water used	1050 ml	84.99

The process of cooking of mushroom formula 1 was as same as chicken formula 1. The only change was soybean and mushroom are substituted in chicken and spinach respectively.

Table 5: Formulation of mushroom formula 2.

Ingredients	Quantity (g and ml)	Percent (%)
Ricberry flour	120 g	7.82
Soybean	10 g	0.65
Mushroom	10 g	0.65
Rice bran oil	15 g	0.98
Mushroom stock seasoning	15 g	0.98
Garlic powder	15 g	0.98
White pepper	0.5 g	0.33
Total water used	1350 ml	87.92

The process of cooking of mushroom formula 2 was as same as chicken formula 2. The only change was soybean and mushroom are substituted in chicken and spinach.250 g of each formula was filled in retort pouches followed by sealing the pouches and sterilized in autoclaving machine for 25 minutes at 121°C.

F_0 Value Determination

Horizontal water spray retort was used to sterilize the product which total contained 160 pouches for each flavor. The sterilization process condition for mushroom was 121°C using 19 min (F0 = 6 min, at pressure = 2 bar). The condition for chicken was 121°C using 26 min (F0 = 6 min , at pressure = 2 bar). Another batch contained 50 pouches for each flavor. The sterilization process condition of mushroom flavor in this batch was 121°C using 38 min (F0 = 10 min, at pressure = 1.8 bar). For chicken was 121°C using 37min (F0= 10 min, at pressure = 1.8 bar)

Sensory Evaluation by Comparing Chicken Formula 1 and Chicken Formula 2, Mushroom Formula 1 and Formula 2

30 panelists with age over 50 were participated in this sensory test. The panelists were given a set of chicken formula 1 and 2 and then another set of mushroom formula 1 and 2 afterwards. The sensory evaluation was carried out using 9-point hedonic score and just about right scale (JAR). The samples were served at 60°C. The 30 panelists were asked to rate the samples ranging from 1 (dislike extremely) to 9 (like extremely) as well as to choose one formula out from two chicken formulas, one out from two mushroom formulas and determine levels of liking of each attribute. The attributes in ballot would be consisted of overall liking, saltiness, spices flavor, and viscosity. After testing, the formulas would be selected for the further development.

Sensory Evaluation of Comparison of Chicken Formula, Mushroom Formula and Commercial Food for People Dysphagia that is Available in the Existing Market

30 panelists with age over 50 were participated in this sensory test. Every individual panelist obtained 3 samples of chicken formula, mushroom formula and commercial product for people dysphagia (APF) brand. The sample were served at 60°C apart from APF brand sample was served at 4°C according to the instruction on the packaging.

The sensory evaluation was carried out using 9-point hedonic score and ranking test. The 30 panelists were asked to rate the samples ranging from 1 (dislike extremely) to 9 (like extremely). The attributes in ballot would be contained of overall liking, overall appearances, texture characteristic, taste, and overall flavor. After testing, the formulas would be selected to the final product.

Sensory Evaluation of the Acceptance of Product with Packaging

30 panelists with age over 50 were participated in this sensory test. The sensory evaluation was carried out using 9-point hedonic score and the acceptance of product's packaging. The samples were served at 60°C. The 30 panelists were asked to rate the samples ranging from 1 (dislike extremely) to 9 (like extremely). The attributes in ballot would be having of viscosity after squeezing out of the packaging, appearance, overall taste, overall flavor, viscosity during eating, and overall liking with the questions of asking yes/no questions of product packaging liking.

Determination the Viscosity to Final Product

The samples were measured with viscometer (Brand: Brookfield, Model: LVDV-II). It started with inserting a needle into a viscometer. Filled a 250 ml beaker with 200 ml volume of sample. Dipped the needle into beaker until it reached the marking level. Used one hand to hold the axis of the motor for standing still. Connected the needle in clockwise motion. Pressed the selected Spindle button to select the number of needles to match the needle. And turned on the motor. Press the Set speed button to set the speed of rotation and set speed again to save. The needle gauge was a viscous item with a small gauge and a less viscous gauge. The percent (%) torque must be observed in the near 100% range. Use the 03-05 needle gauge as soon as the speed and accuracy of the needle gauge were reached. The measurements should be made at 25°C (room temperature) and 60°C (soup serving temperature). In each measurement,

measurements should be made at 1°C to ensure that the measurements were stable. When the measurement was finished Reduce speed down to 0, then press the motor off button to stop the motor and turned off the switch.

Evaluation of Proximate analysis of Final Product

The proximate analysis of riceberry pudding would be determined by using AOAC method, 2002[1]. It would consist of moisture, ash, fat, protein and fiber content. All the experiments were done in triplicate.

Moisture Content Determination

For moisture content determination, approximately 5 g to 4 decimals of samples were weighed in the known weight and dry the samples in the hot air oven at temperature at 105°C for 4 hours until it is obtained the constant weight. Remove the samples from oven and cooled it down in the desiccator. Record the result.

$$\text{Moisture Content (\%)} = \frac{weight\ loss}{weight\ of\ sample}\ x\ 100$$

Total solid (%) = 100 - % of moisture content

Ash Content Determination

For ash content determination, approximately 5 g of samples were weighed in known empty-cleaned crucible with its lids. Burn it on a Bunsen burner, with incompletely closed lid until there was no smoke or charred mass. Incinerate at 550°C until all the carbon has been burnt away and light gray to white ash is obtained. Transfer it to desiccator and cool it down. Record the result.

$$\text{Ash content (\%)} = \frac{weight\ of\ ash}{weight\ of\ sample}\ x\ 100$$

Crude Fat Determination

For fat content determination, dry the sample in hot air oven at 105°C. mash the dry sample using mortar and pestle until the sample were all ground. Weigh the sample and used Soxhlet Extractor to extract the crude fat. Record the result.

$$\text{Crude fat (\%)} = \frac{weight\ of\ extracted\ fat}{weight\ of\ sample}\ x\ 100$$

Crude Protein Determination

For protein content determination, the dry and defatted samples that obtained from fat content determination were used in protein content determination. Using Macro-Kjeldahl method to find out crude protein content.

$$\text{Nitrogen content (\%)} = \frac{14.01\ x\ (V_S - V_b) x\ conc\ of\ HCl}{weight\ of\ sample\ x\ 10},$$

Where, V_s = volume used by sample and V_b = volume used by blank

Crude protein = nitrogen content (%) x conversion factor (F)

Ash Content Determination

For fiber content determination, the dry and defatted samples that obtained from fat content determination were used in fiber content determination.

$$\text{Crude fiber (\%)} = \frac{weight\ of\ crude\ fiber}{weight\ of\ sample}\ x\ 100$$

Microbiological Testing of Accelerated Shelf Life Study of Final Product

By performing accelerated shelf life, samples were incubated at room temperature, 37°C and 55°C. The microbiological testing of accelerated shelf life would be determined by carrying out low acid (sterility tests)[4]. The sterility tests consist of flat sour (thermophilic and mesophilic), thermophile anaerobe, and sulfide spoilage test. All the experiments were done in duplicate and two replications. Incubating temperature 37°C was used to represent the standard room temperature, 37°C represented room temperature in Thailand and 55°C might represent the temperature in the warehouse which sometimes could fluctuate.

Evaluation of the Final Products by Using Consumer Acceptance

100 consumers would participate in this consumer test to taste the product out from the packaging. The method was using central test location and home use test. In the ballot, it consisted three parts of consumer test questionnaire. First part, it would ask about the daily behavior of the participated individual. Second part would be asking the individuals to test the products and give the scores for attributes using 9-point hedonic scale, from 1(dislike extremely) to 9 (like extremely) . The attributes in ballot were consisted of color, aroma, taste, texture, viscosity, convenience, packaging, and overall like. Third part would be the questionnaire of demographics along with the questions of swallowing disturbance questionnaire and Temporomandibular Disorder Hypersalivation (TMD). In swallowing disturbance questionnaire[20], the individuals would be asked to tick on the how frequent which described as never = 0 ,seldom (once a month or less = 1), frequently (1-7 times a week = 2), and (very frequently = 3) that they would encounter the problems or difficulty experience in swallowing. Temporomandibular Disorder Hypersalivation or TMD would consist both yes/no questions.

Statistics Analysis

All data were recorded as average ± standard deviation. The significant difference was determined by using ANOVA. The data was subjected to two samples independent t-test with $p<0.05$ were regarded as significantly different.

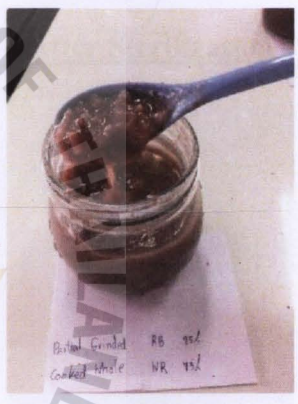
Result and Discussion

Table 6: Result of Preliminary Study

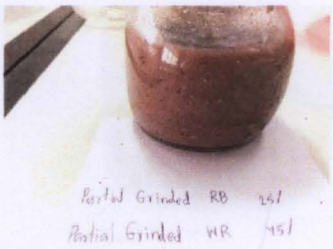
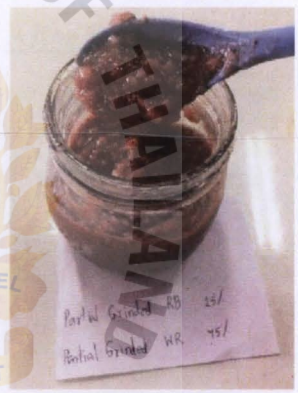
Method	Ingredients	Percentage of rice added	Volume(ml) of water used	Cooking time(min)	After sterilization
1	Whole cooked white rice	75	700	30	X
	Partially grinded riceberry	25			
2	Partially grinded white rice	75	1700	30	X
	Partially grinded riceberry	25			
3	white rice flour	75	1400	30	X
	Partially grinded riceberry	25			
4	riceberry flour	100	1700	30	X
5	Riceberry flour	100	900	30	✓
6	Riceberry flour	100	700	30	✓

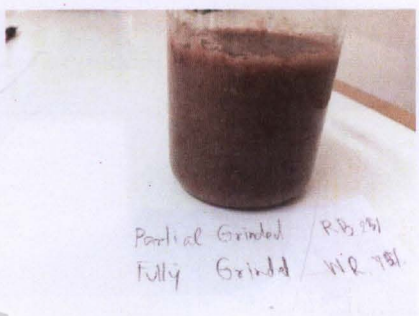
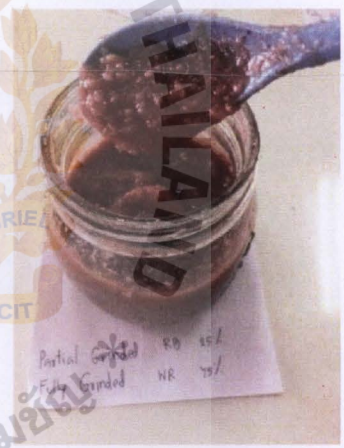
Note: ✓ refers to no separation phases, no color and odor changes while X represents there are separation phases, color and aroma changes.

Table 7: Result of Preliminary Study with Illustrations.

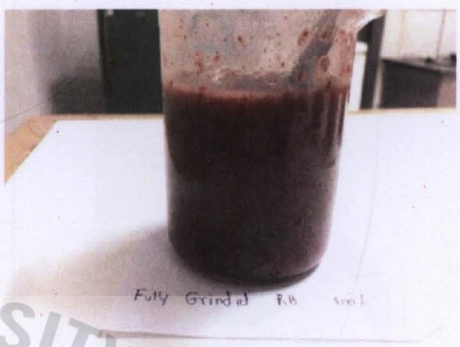
Method	Results of before and after Sterilization	Illustration of before and after sterilization
1	**Before Sterilization** Color is greyish and slightly greenish. Lager particles of rice. Very watery viscosity **After Sterilization** It separates into two phases. Larger particles of rice . Watery viscosity	**Before Sterilization**  **After Sterilization** 

Continue

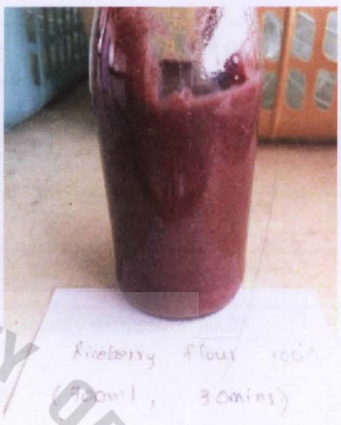
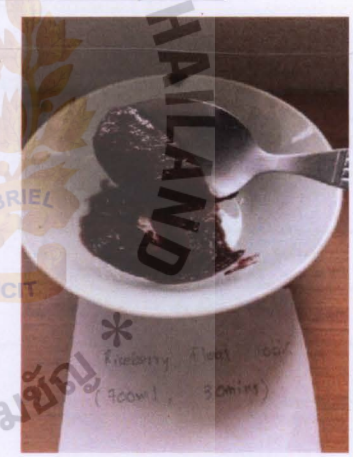
Method	Results of before and after Sterilization	Illustration of before and after sterilization
2	**Before Sterilization** Color is greyish and slightly greenish. Smaller particles of rice mixture. Slightly watery viscosity Rice mixture does not hold water fully. **After Sterilization** Particles of rice mixture remains in the same size as before sterilization. Less watery viscosity. Color is greyish purple.	**Before Sterilization**  **After Sterilization** 

Continue		
Method	**Results of before and after Sterilization**	**Illustration of before and after sterilization**
3	**Before Sterilization** Color is greyish. .. Homogenized mixture. More viscous and smaller white rice particles **After Sterilization** Rice mixture can hold water and it does not separate into two phases Particles of rice mixture remains in the same size as before sterilization Viscosity remains as before sterilization. Color is greyish and homogenized mixture	**Before Sterilization**  **After Sterilization** 

Continue

Method	Results of before and after Sterilization	Illustration of before and after sterilization
4	**Before Sterilization** Color is reddish purple Homogenized mixture and texture is smooth **After Sterilization** Particles of riceberry can hold water and it does not separate into two phases. Particles of riceberry remains in the same size as before sterilization. Viscosity remains as before sterilization. Color is reddish purple. Homogenized mixture Texture is smooth	**Before Sterilization**  **After Sterilization** 

Continue		
Method	**Results of before and after Sterilization**	**Illustration of before and after sterilization**
5	**Before sterilization** Color is reddish purple Homogenized mixture More viscous than method 4 Texture is smooth **After sterilization** Particles of riceberry can hold water and it does not separate into two phases. Particles of riceberry remains in the same size as before sterilization. Viscosity remains as before sterilization. Color is reddish purple. Homogenized mixture Texture is smooth	**Before Sterilization**  **After Sterilization** 

Continue		
Method	**Results of before and after Sterilization**	**Illustration of before and after sterilization**
6	**Before sterilization** Color is deep reddish purple. Homogenized mixture More viscous than method 5. Texture is smoother than method 5 **After sterilization** Particles of riceberry can hold water greater and it does not separate into two phases. Color is deep reddish purple. Viscosity remains as before sterilization and more viscous than method 5 Homogenized mixture. Texture is smoother than method 5	**Before Sterilization**  **After Sterilization** 

After preliminary study was complete, method 5 and 6 were chosen to use in further experiment because the result of method 5 and 6 gave similar pudding-liked texture to the characteristics of reference which were no lumps or smooth texture, no separation of liquid from solid, hold shape on spoon, and so on. The products were aimed to develop two flavors, chicken and mushroom.

Sensory Evaluation by Comparing Chicken Formula 1 and Chicken Formula 2, Mushroom Formula 1 and Formula 2

Table 8: Mean and Standard Deviation of sensory attributes of Chicken Formula 1 and 2.

Attributes	Mean ± SD	
	Chicken Formula1	Chicken Formula 2
Viscosity intensity	7.4 ± 1.7[a]	7.2 ± 1.3[a]
Saltiness	7.4 ± 1.6[a]	7.0 ± 1.4[a]
Spices flavor intensity	7.2 ± 1.5[a]	7.0± 1.5[a]
Overall like	7.7± 0.9[a]	7.2± 1.5[a]

Means ± Standard deviation with the same letter within a row are not significantly different P>0.05.

Scale ranges from 1-9 where 1 is dislike extremely and 9 is like extremely.

Table 9: Mean and Standard Deviation of Sensory Attributes of Mushroom Formula 1 and 2.

Attributes	Mean ± SD	
	Mushroom Formula 1	Mushroom Formula 2
Viscosity intensity	6.9±1.9[a]	7.1±1.7[a]
Saltiness	6.6±1.8[a]	6.7±1.4[a]
Spices flavor intensity	6.9±1.6[a]	6.9±1.4[a]
Overall like	6.8±1.8[a]	7.0 ±1.5[a]

Means ± Standard deviation with the same letter within a row are not significantly

Scale ranges from 1-9 where 1 is dislike extremely and 9 is like extremely.

Table 10: Just-right votes of Chicken Formula 1 and 2 .

Attributes	Percent of just-right votes (%)	
	Chicken Formula 1	Chicken Formula 2
Viscosity	85.7	60.7
Saltiness	78.6	60.7
Spices flavor	71.4	53.6

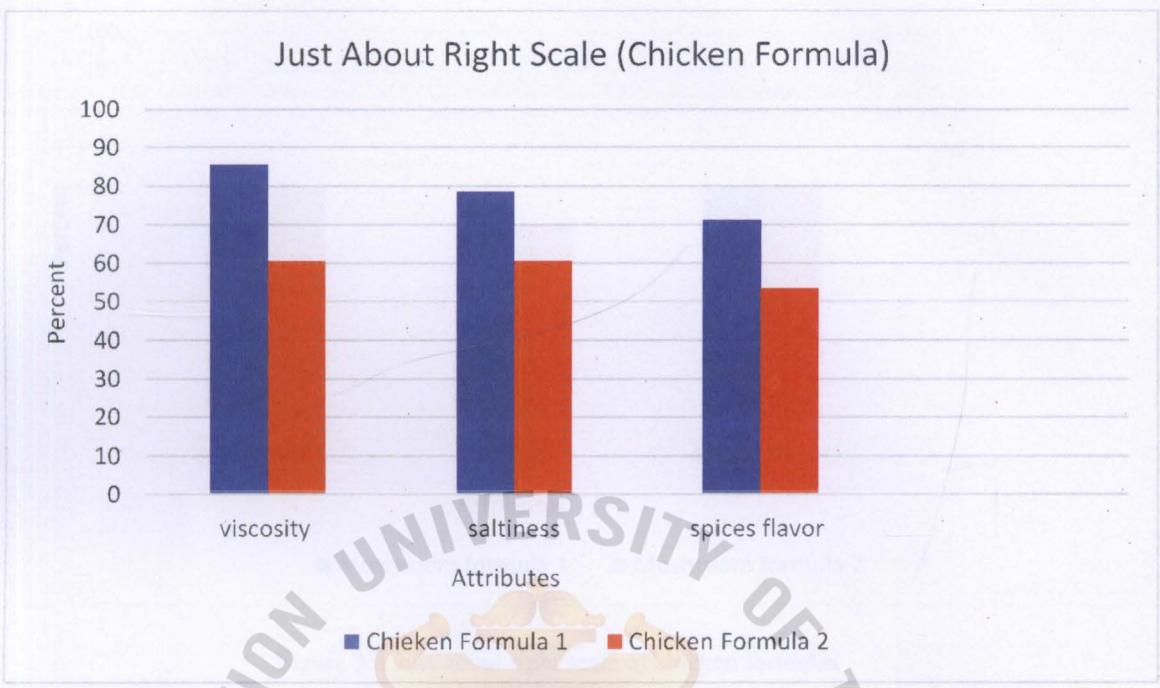


Figure 2: Just about right scale of chicken formulas

Table 11:: Just-right votes of Mushroom Formula 1 and 2 .

Attributes	Percent of just about right (%)	
	Mushroom Formula 1	Mushroom Formula 2
Viscosity	50.0	60.7
Saltiness	57.1	50.0
Spices flavor	60.7	60.7

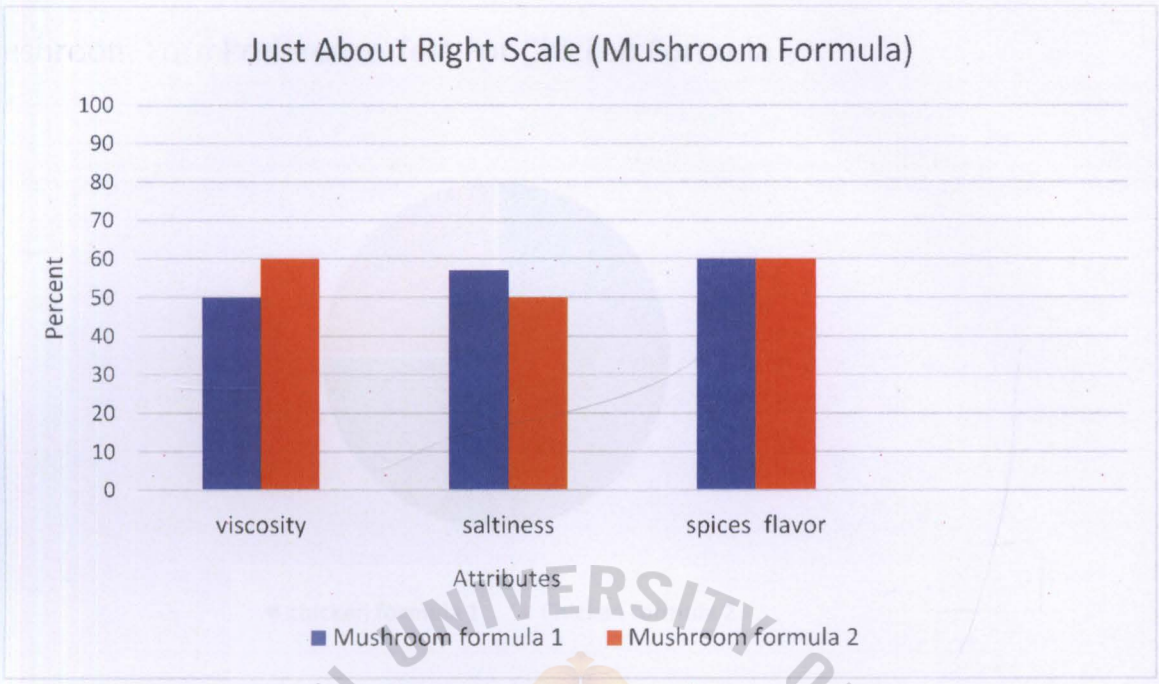


Figure 3: : Just about right scale of chicken formulas

Preference Test Result

Table 12: Preference Test for Chicken Formula

Formula	Percent (%)
Chicken Formula 1	75.0
Chicken Formula 2	25.0

Table 13: Preference Test for Mushroom Formula

Formula	Percent (%)
Mushroom Formula 1	64.3
Mushroom Formula 2	35.7

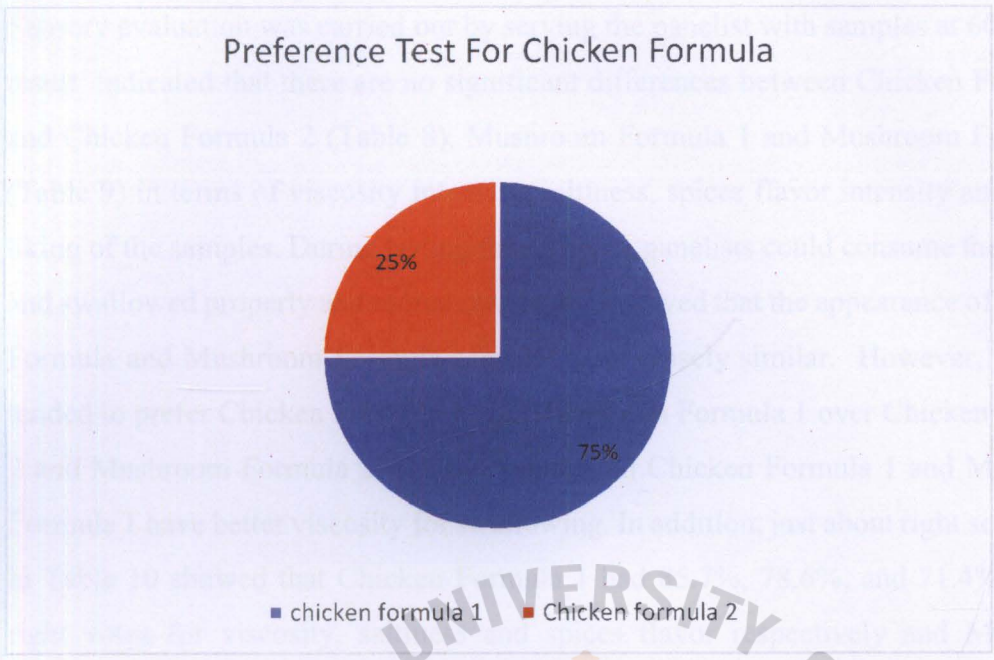


Figure 4: Preference test for chicken formula

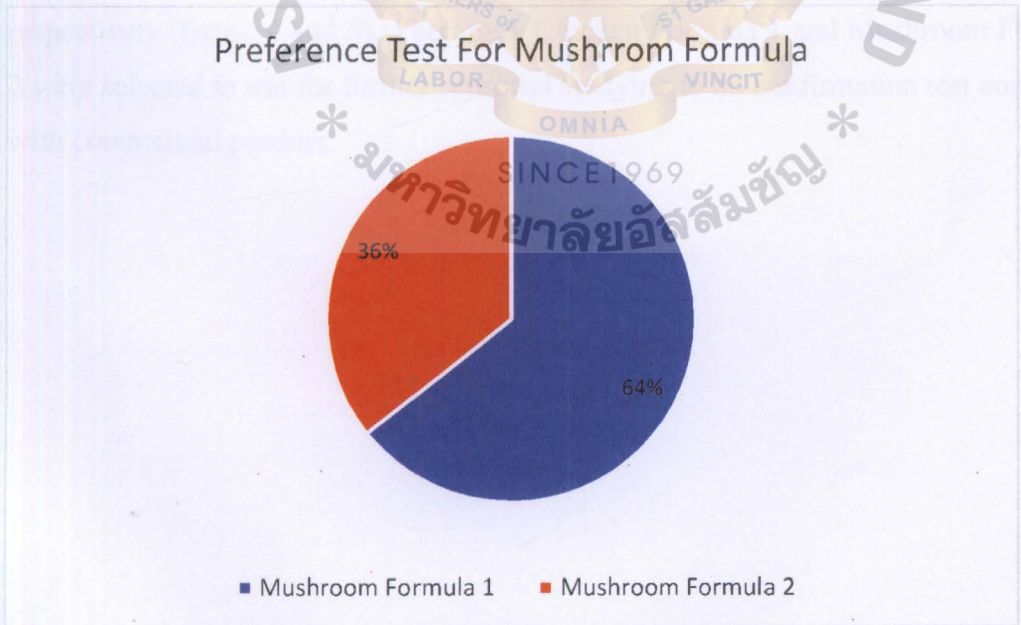


Figure 5: Preference test for mushroom formula

Sensory evaluation was carried out by serving the panelist with samples at 60°C. The result indicated that there are no significant differences between Chicken Formula 1 and Chicken Formula 2 (Table 8), Mushroom Formula 1 and Mushroom Formula 2 (Table 9) in terms of viscosity intensity, saltiness, spices flavor intensity and overall liking of the samples. During tasting the samples, panelists could consume the product and swallowed properly and moreover, it was observed that the appearance of Chicken Formula and Mushroom Formula samples were closely similar. However, panelists tended to prefer Chicken Formula 1 and Mushroom Formula 1 over Chicken Formula 2 and Mushroom Formula 2 as they commented Chicken Formula 1 and Mushroom Formula 1 have better viscosity for swallowing. In addition, just about right scale (JAR) in Table 10 showed that Chicken Formula 1 had 85.7%, 78.6%, and 71.4% of just-right votes for viscosity, saltiness and spices flavor respectively and Mushroom Formula 1 had 50% , 57%, and 61% votes for just-right of viscosity, saltiness and spices flavor respectively. A common bench- mark is approximately 80% JAR vote in the middle category[13]. In contrast, the percent of just about right votes for viscosity, saltiness and spices flavor of Chicken Formula 2 and Mushroom Formula 2 were obviously lower than chicken formula 1 and mushroom formula 1. In preference test, chicken formula 1 and mushroom formula 1 were preferred by panelists 75% and 64% respectively (figure 4 and 5). Therefore, Chicken Formula 1 and Mushroom Formula 2 were selected to use for further sensorial studying to do confirmation test compared with commercial product.

Study Comparison of Chicken Formula, Mushroom Formula and Commercial Food for People Dysphagia that is Available in the Existing Market

Table 14: Mean and Standard Deviation of Chicken formula 1, Mushroom Formula 1, and APF food brand.

Attributes	Mean ± SD		
	Chicken Formula 1	Mushroom Formula 1	Pudding powder (APF brand)
Overall like	7.4 ± 0.3^{a}	7.4 ± 0.3^{a}	5.1 ± 0.4^{b}
Overall appearance	7.2 ± 0.2^{a}	7.4 ± 0.3^{a}	5.2 ± 0.4^{b}
Texture characteristic	7.3 ± 0.3^{a}	7.3 ± 0.2^{a}	5.5 ± 0.5^{b}
Taste	7.5 ± 0.3^{a}	7.3 ± 0.3^{a}	5.2 ± 0.5^{b}
Overall flavor	7.2 ± 0.3^{a}	7.5 ± 0.2^{a}	5.4 ± 0.4^{b}

Means ± Standard deviation with the same letter within a row are not significantly different P>0.05.

Table 15: Percent of ranking order of chicken formula 1, mushroom formula 1 and APF brand.

Ranking order	Percent of Ranking Order		
	Chicken formula 1	Mushroom formula 1	APF brand
1	64.3	32.1	3.6
2	32.1	53.6	14.3
3	3.6	14.3	82.1

Figure 6: Ranking scores chicken formula 1, mushroom formula 1 and APF brand

The sensorial attributes of Chicken Formula 1 and Mushroom Formula 1 showed no significant difference from each other shown in Table 14, but both these samples were different significantly from APF brand. It means that the sensory perception of panelists towards Chicken Formula 1 and Mushroom Formula 1 were similar apart from APF brand. APF pudding power is commercial product that is existing in the market. It has white color and pudding-liked consistency after boiling with water. Moreover, Chicken Formula 1 ranked in the highest percentage of liking among three samples, illustrated in Figure 6 It was also observed that, panelists tended to prefer that sample that has chicken meat in it. Comparing between mean scores for three sample, it could be seen that APF brand was significantly lower than chicken formula 1 and mushroom formula 2. In figure 6, it could be observed that chicken formula 1 ranked in the first place of ranking test, followed by mushroom formula 2 and APF brand ranked in 3rd place.

Study the Acceptance of Product with Packaging

Table 16: Mean and Standard Deviation of Attributes of chicken formula 1.

Attributes	Mean ± SD (Chicken Formula 1)
viscosity after squeezing out of the packaging	7.8±1.3
Appearance	7.6±0.9
overall taste	7.5±1.3
overall flavor	7.8±0.8
viscosity during eating	7.6±1.3
overall liking	8.0±1.1

Table 17: Mean and Standard Deviation of attributes of mushroom formula 1.

Attributes	Mean ± SD (Mushroom Formula 2)
viscosity after squeezing out of the packaging	7.3±2.1
Appearance	7.0±1.4
overall taste	7.5±1.6
overall flavor	7.3±1.6
viscosity during eating	7.4±2.0
overall liking	7.9 ±1.1

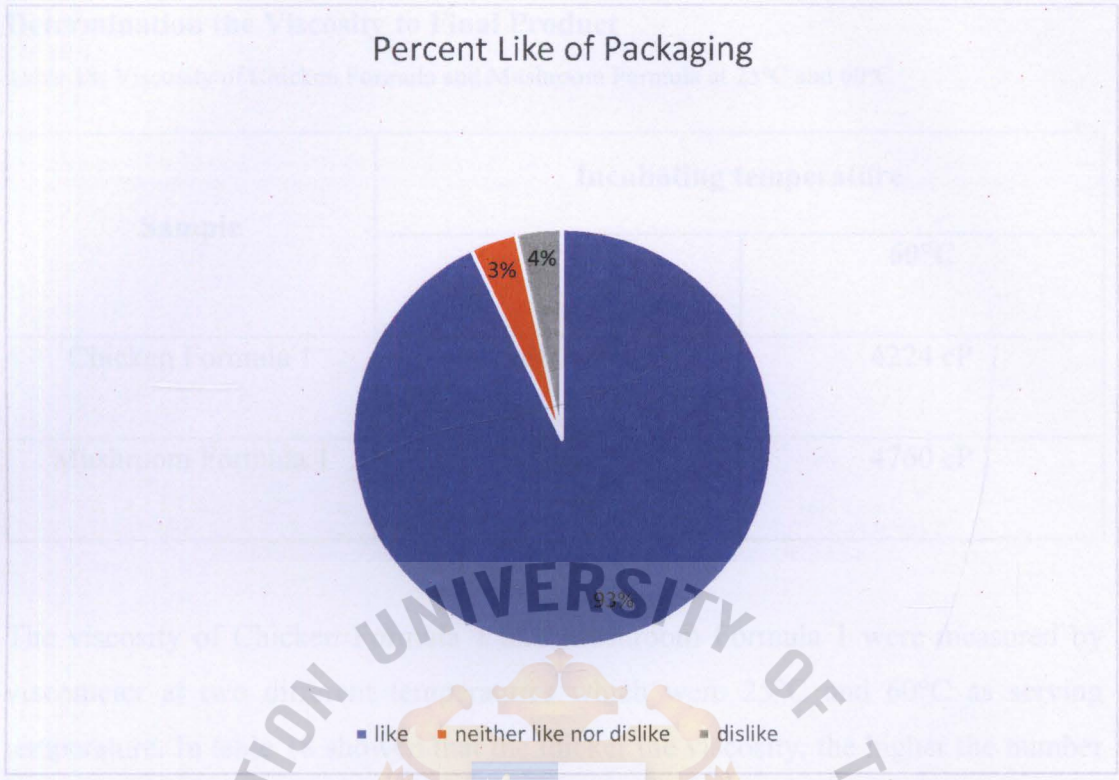


Figure 7: Percentage liking of packaging.

The Chicken Formula 1 and Mushroom Formula 2 were packed in retort pouches with inserted tubes for consuming, were severed individually at 60°C to the panelists. According to the result, overall liking score for Chicken Formula 1 and Mushroom Formula 1 were 7.8 ±1.3 and 7.3 ± 2.1 respectively Table 16 and 17, which meant panelists like consuming moderately straight out from the retort packaging. Moreover, the percent of like, neither like nor dislike, dislike of consuming samples out from the retort pouch was shown in Figure7. The reasons of having moderate like of consuming samples where it was convenient and easy to carry, easy to consume straight out from the retort pouch and hygiene that retort pouch provided to the panelist.

Determination the Viscosity to Final Product

Table 18: Viscosity of Chicken Formula and Mushroom Formula at 25°C and 60°C

Sample	Incubating temperature	
	25°C	60°C
Chicken Formula 1	9080 cP	4224 cP
Mushroom Formula 1	11060 cP	4760 cP

The viscosity of Chicken Formula 1 and Mushroom Formula 1 were measured by viscometer at two different temperatures which were 25°C and 60°C as serving temperature. In table 18 showed that the thicker the viscosity, the higher the number of centipoise (cP) is 4224cP and 4760 cP for Chciken Formula 1 and Mushroom Formula 1 respectively. Moreover, the lower the temperature gives higher or thicker viscosity, 9080 cP and 11060 cP for Chicken Formula 1 and Mushroom Formula 1 respectively. During the pasting process, the starch granules start to swell first, and this swelling event is followed by the melting of crystals and then the paste becoming viscous[30]. Riceberry flour has low amylose and it would swell easier might represent a weaker binding force in that starch granule and upon heating its viscosity could increase at lower temperature[14]. Starch molecules thus become instable at higher temperature and their molecular chains break down and consequently the viscosity is declined. At higher temperature the hydrogen bonding system in starches or in between starch and water molecules may have been fragile and/or broken down which may result in a decrease in hydration volume of the molecules which may contribute to the reduction in intrinsic viscosity. The relatively lower viscosity at higher temperature may also be due to the tendency of complete release of linear chains surrounding the starch molecules[22]. Therefore, this range of viscosity is within acceptable range to be determined it is safe for swallowing. According to National Dysphagia Diet Task Force (NDDTF), spoon-thick or pudding liked texture has a viscosity of greater than 1750 cP[24]. After passing sterilization passing using horizontal water spray retort and cooling down, some samples were observed to have liquid separated from solids in the pouch.

The reason might be due to the syneresis occurred after cooling process. The water is freed from a cooked, cooled starch gel caused by retrogradation. It is liquid separates from a gel upon standing[34]. Retrogradation occurs in higher chance when the sample is stored at lower temperature. In the previous study said that low temperature storage not only accelerates starch retrogradation but also makes more noticeable on whatever interaction between the different starch polymers that lead to higher than expected retrogradation rate[5].

Evaluation of Proximate Analysis of the Product

Table 19: Mean and standard deviation of chemical composition in chicken formula 1.

Proximate Composition	Mean ± SD (Chicken Formula 1)
Moisture	85.4 ± 0.1
Ash	0.9 ± 0.0
Fat	4.8 ±0.1
Protein	4.6 ± 0.1
Fiber	0.8 ± 0.1
Total carbohydrate	14.6 ± 0.1

Table 20: Mean and Standard Deviation of chemical composition in mushroom formula 1.

Proximate Composition	Mean ± SD (Mushroom Formula 1)
Moisture	84.9± 0.0
Ash	0.9± 0.0
Fat	5.9 ± 0.2
Protein	2.3 ± 0.1
Fiber	0.1 ± 0.0
Total carbohydrate	15.1 ± 0.1

In Table 19 and 20 , it can be seen that moisture content for both Chicken Formula 1 an Mushroom Formula 1 has the higher percent among other nutrients. As liquid is added to promote smooth texture, and it can have influence on nutrients profiles[11]. Foods that are pureed to obtain pudding like texture may have significant difference in terms of nutrients[16]. Previous research on the protein content of in-house pureed foods revealed that residents on a pureed diet consumed only 40 g of protein compared to 60 g of protein consumed by residents on a regular diet. They also consumed significantly less energy intake with only 923 kcal versus 1456 kcal for those on a regular diet[6]. There are possible several reasons behind the nutrient loss such as nutrients loss during the process of cooking, water spray sterilization and yield loss during product transfer from one place to another place. According to Ministry of Health in New Zealand, recommended dietary intake (RDI) for aging population (women, age 65 to 75+) and (men, age 65-75+) of macronutrients such as protein is ranging from 46 g to 57g for women 64 g to 81 g for men. For fiber intake is 16.6 g to 17.4 g for women 19.5 g to 21.6 g for men. Carbohydrate intake is 169 g to 181 g for women 213 g to 228 for men. Fat intake is 51 g to 55 g for women, 63 g to 75 g for men[23] .

Evaluation of Microbiological Testing of Accelerated Shelf Life Final Product

Table 21: Flat sour test (Mesophilic) incubated at 37°C

Sample	Incubating Temperature		
	Room temperature	37°C	55°C
Chicken formula	Negative	Negative	Negative
Mushroom formula	Negative	Negative	Negative

Table 22: Flat sour test (Thermophilic) incubated at 55°C

Sample	Incubating Temperature		
	Room temperature	37°C	55°C
Chicken formula	Negative	Negative	Negative
Mushroom formula	Negative	Negative	Negative

Table 23: Thermophilic anaerobe test.

Sample	Incubating Temperature		
	Room temperature	37°C	55°C
Chicken formula	Negative	Negative	Negative
Mushroom formula	Negative	Negative	Negative

Table 24: Sulfide Spoilage Test .

Sample	Incubating Temperature		
	Room temperature	37°C	55°C
hicken formula	Negative	Negative	Negative
Mushroom formula	Negative	Negative	Negative

The chicken and mushroom riceberry pudding samples are low acid food and tested for accelerated shelf life by using Sterility test and incubated at 3 different temperature, which are room temperature, 37°C, and 55°C. In table 21, 22, 23, and 24, the result indicated that it was negative for flat sour test (thermophilic and mesophilic),

thermophilic anaerobe test, and sulfide spoilage test. The absence of microorganisms is very crucial for the safety of product itself. During the sterilization process using F_0 = 6 min, within the observation, there were positive result of microorganisms present in the mushroom flavor samples that incubated at 37°C and 55°C in flat sour test. However, there was only the presence of microorganisms in mushroom flavor samples incubated at 55°C in thermophilic anaerobe test. But there was all negative result for sulfide spoilage test. There are a few possible reasons that could support this observation. Using F_0 = 6 min as value to destroy specific number of microorganisms would not be sufficient for lager batch that mentioned in materials and methods. It would be possibly due to initial contamination of microorganisms. Therefore, food safety and food sanitation should be applied strictly in this part. The higher initial contamination could be regarded either as a ten times larger number of microorganisms, or as the initial contamination of a ten times larger unit. If the unit is not considered in a single retort pouch but as the whole of all the items produced over a number of time, the initial number of microorganisms present in each has to be multiplied times the number of items produced, and the exposure times to achieve the decreasing to the same number of viable microorganisms left in the whole of the items produced. It has to be parallelly increased[9]. Another reason could be the viscosity of sample in different batch of cooking. The range viscosity of sample should be fixed. As the viscosity of sample could have effect on heat penetration rate.

Evaluation of the Final Products by Using Consumer Acceptance

Consumer test (Part I: Daily Behavior of Participate Individuals)

1. How many meals do you have in a day

Response	Percent (%)
1 meal	0.7
2 meals	8.7
3 meals	85.7
Others	0.8
No response	4.8

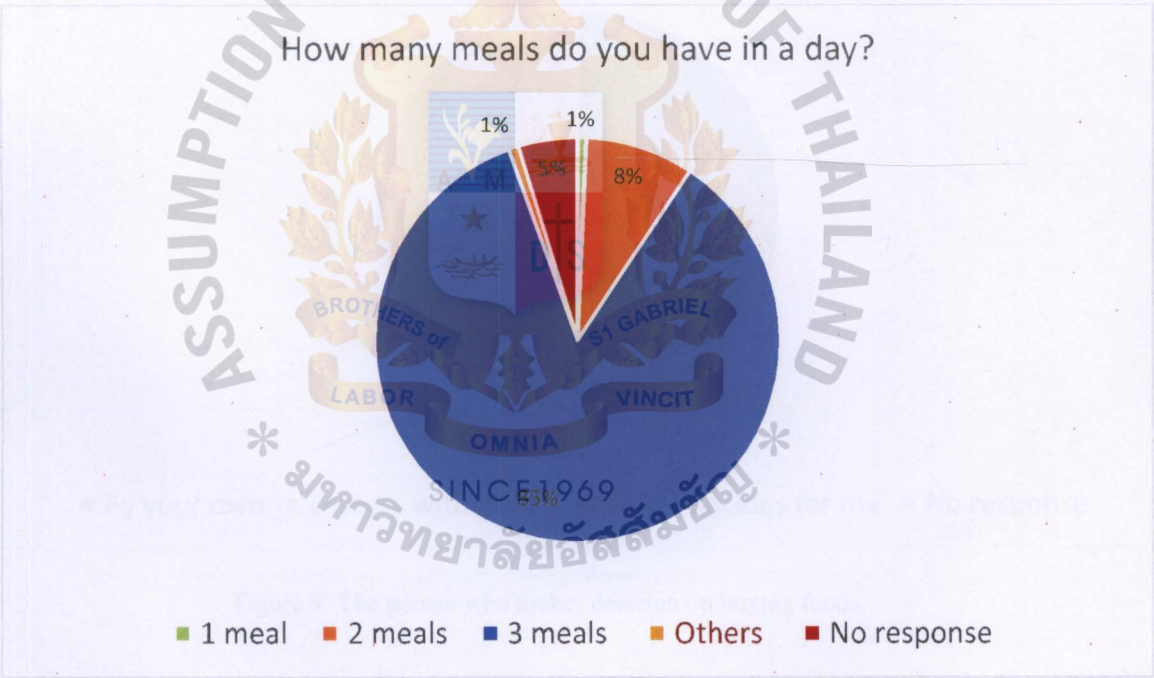


Figure 8: Frequency of having meals in a day.

2. Who makes decision on buying foods?

Response	Percent
By your own	67.7
Discuss with others	10.2
Other decides for me	16.5
No response	5.5

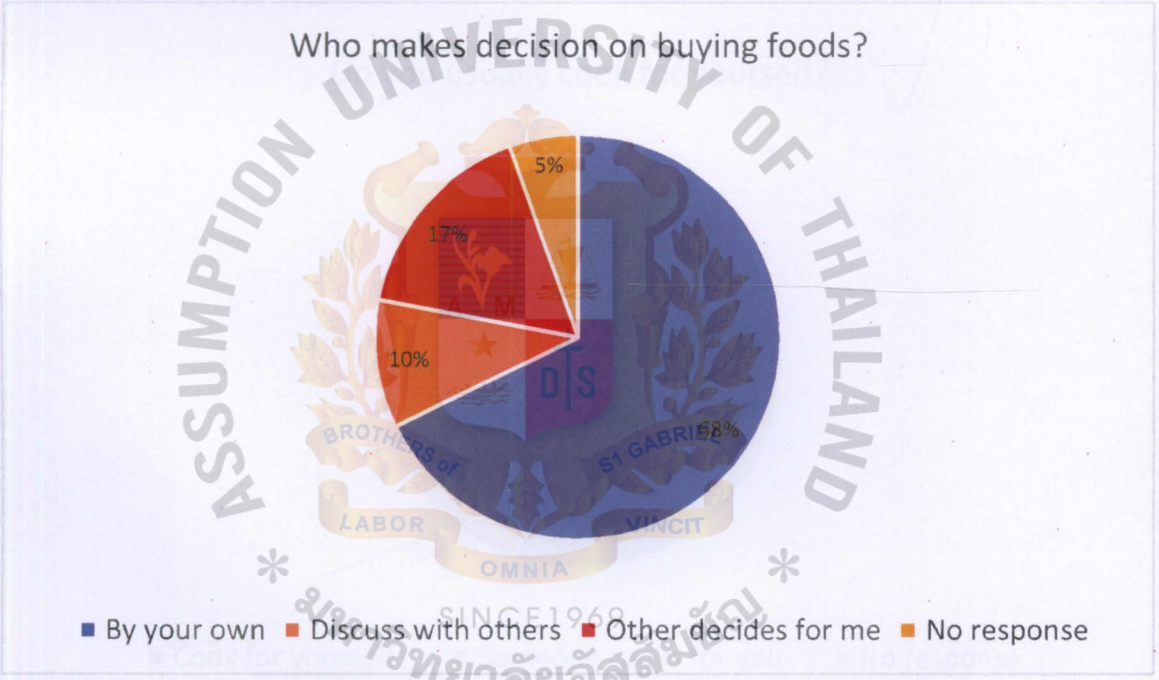


Figure 9: The person who makes decision on buying foods.

3. Do you usually cook for yourself?

Response	Percent
Cook for yourself	55.1
Someone cooks for you	39.4
No response	5.5

Figure 10: The percent of how much consumers cook for themselves.

4. How much do you spend on a meal?

Response	Percent
<50 baht	17.3
50-100 baht	61.4
101-150 baht	3.9
15-120 baht	3.2
201-250 baht	0.8
>250 baht	0
No response	14.4

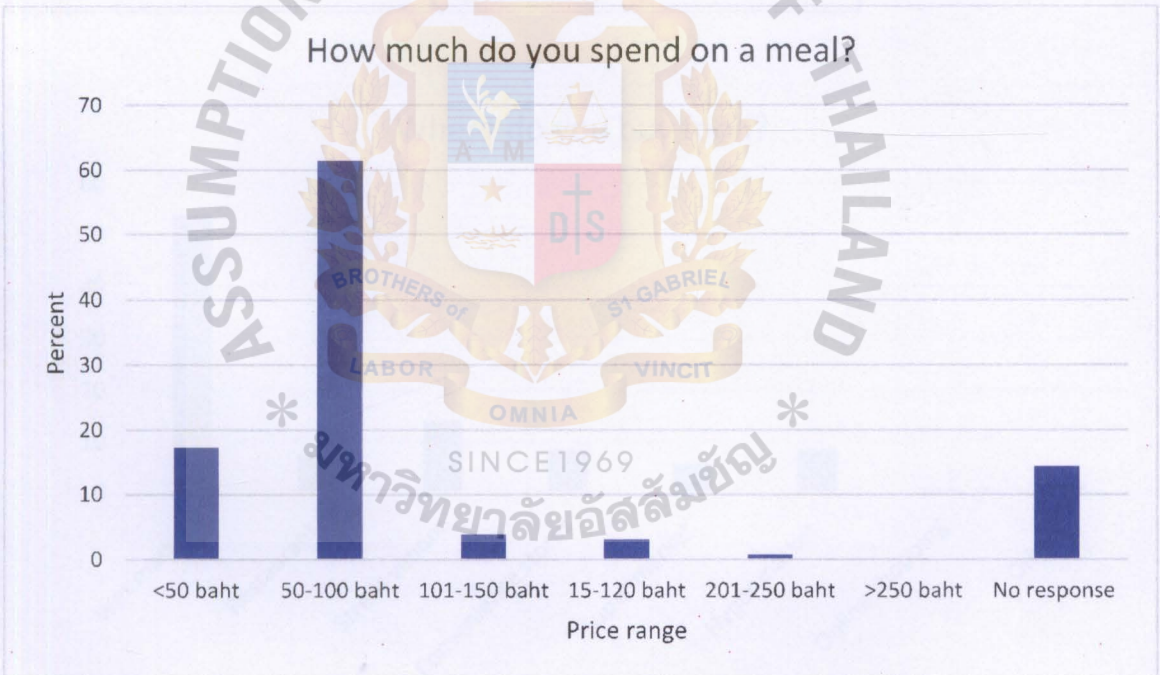


Figure 11: The percent of price consumer would spend on a meal.

5. Where do you buy food?

Response	Percent
Wet market	53.9
Restaurant	7.3
Street vendor	14.0
Convenience stores	8.4
Super market	5.6
Hyper market	8.4
Online shopping	0.6
Others	1.7

Figure 12: The locations where consumer usually buy foods.

6. How often do you buy meal?

Response	Percent
Everyday	54.3
Every week	19.7
Every two weeks	8.7
Once a month	2.4
Others	2.4
No response	11.8

Figure 13: The time frequency of buying foods

7. In what occasion do you buy food?

Response	Percent
When food is finished	76.5
On sales or promotion	7.8
Recommended by someone	4.3
Others	11.3

Figure 14: The occasion when consumers buy foods.

8. What kind of product do you usually choose?

Response	Percent
No sugar or low sugar	24.4
No fat or non-fat	16.8
No cholesterol	8.8
Low sodium	6.7
No preservatives	6.3
No MSG	14.7
Low calories	2.1
From natural such as herbs	6.7
Can eat everything	13.5

Figure 15: The variety types of products that consumer would buy.

9. Which taste do you like the most?

Response	Percent
bland	30.8
Sour	13.7
Sweet	17.0
Salty	14.8
Bitter	3.3
Spicy	14.3
Others	6.0

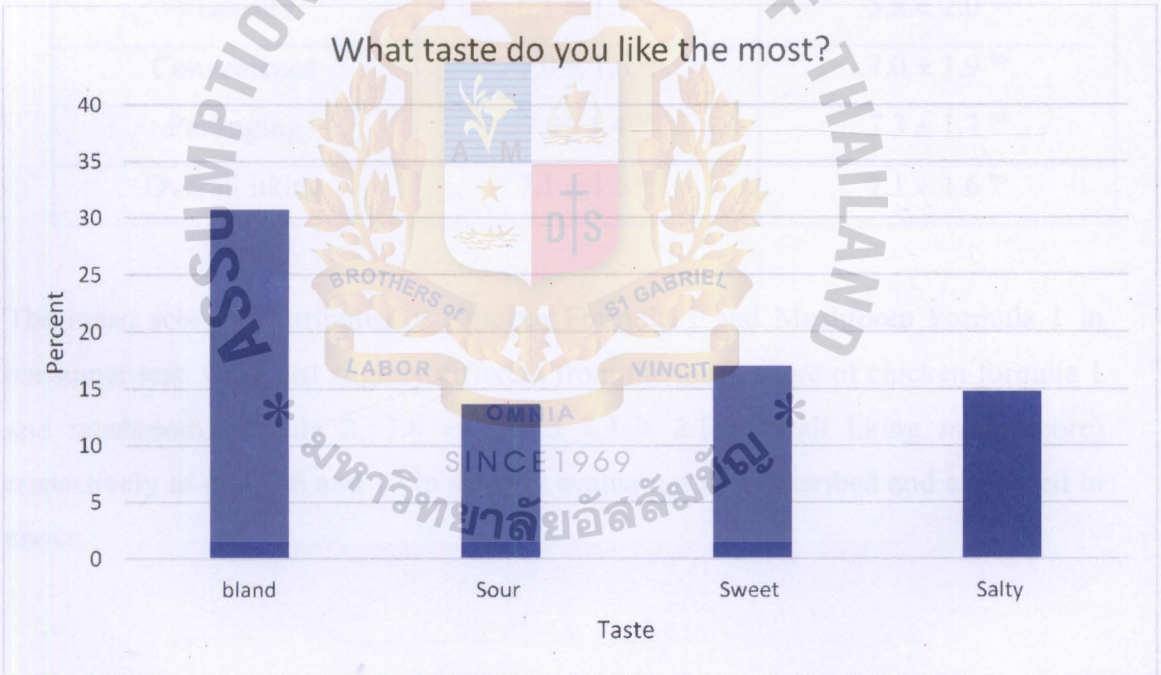


Figure 16: The percent of different tastes of product that consumer like.

Consumer Test (Part II: 9-point Hedonic Scores of Final Product)

Table 25: Mean and Standard Deviation of chicken and mushroom formula final product.

Attributes	Mean ± SD	
	(Chicken formula 1)	(Mushroom formula 2)
Color	6.3 ± 1.7 ^{ns}	6.3 ± 2.0 ^{ns}
Aroma	6.4 ± 1.8 ^{ns}	6.1 ± 1.8 ^{ns}
Taste	6.5 ± 1.8 ^{ns}	6.1± 1.7 ^{ns}
Texture	6.5 ± 1.3 ^{ns}	6.0 ± 1.8 ^{ns}
Viscosity	6.1 ± 1.7 ^{ns}	5.8 ± 2.0 ^{ns}
Convenience	7.0 ± 1.6 ^{ns}	7.0 ± 1.9 ^{ns}
Packaging	7.4± 1.4 ^{ns}	7.3 ± 1.7 ^{ns}
Overall liking	7.1 ± 1.5 ^{ns}	7.1 ± 1.6 ^{ns}

The mean score of attributes of Chicken Formula 1 and Mushroom Formula 1 in consumer test were just slightly different from the mean score of chicken formula 1 and mushroom formula 2, 7.8 ±1.3 and 7.3 ± 2.1 (overall liking mean score) respectively in table 16 and 17 in sensory evaluation that described and explained in above.

1. Do you accept this product?

Response	Percent	
	Yes	No
Chicken formula 1	37	3
Mushroom formula 1	44	4
No response	12	

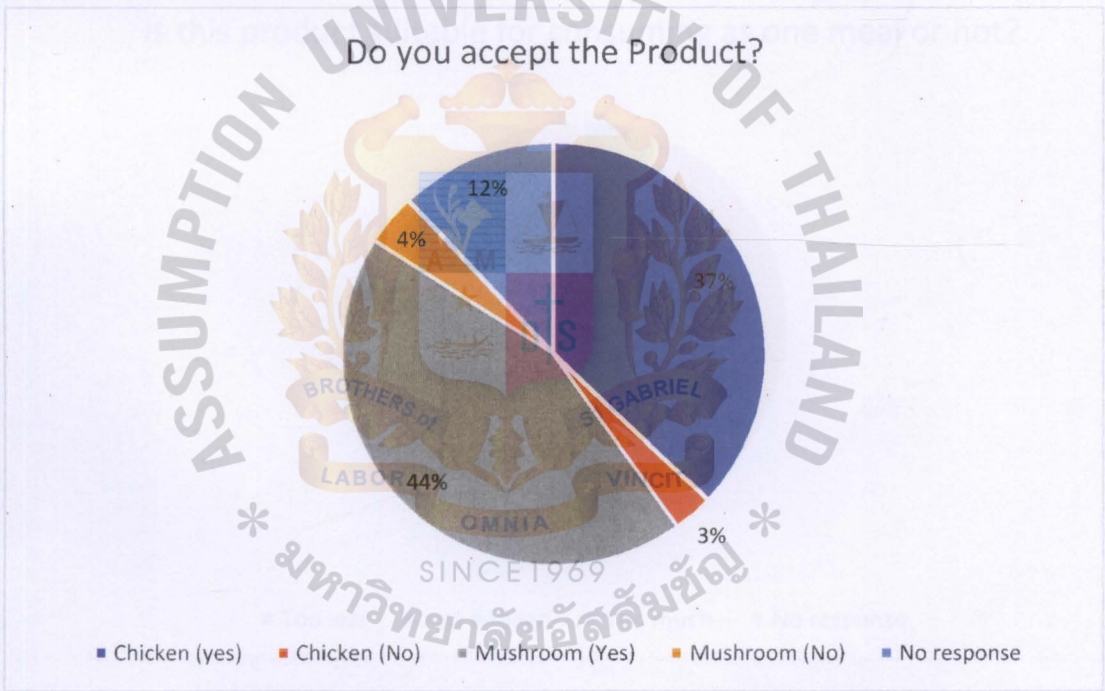


Figure 17: The acceptance percent of consumers towards the products.

2. Is this product suitable for consuming as one meal or not?

Response	Percent
Too less	6
Just enough	75
Too much	8
No response	14

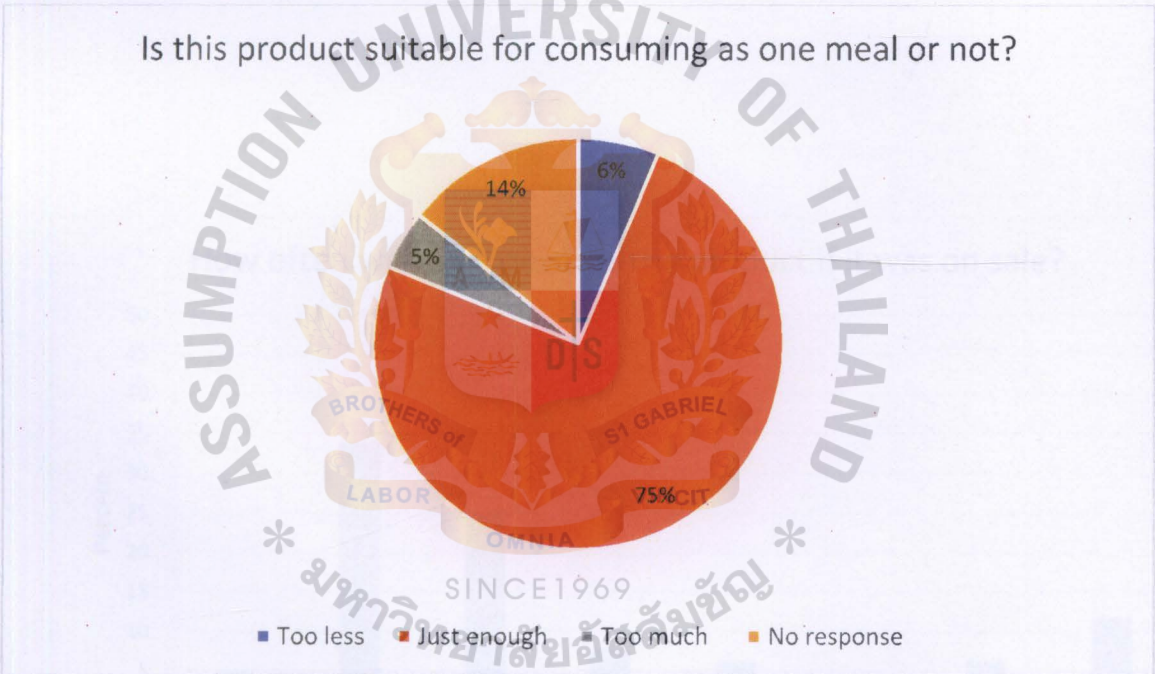


Figure 18: Percent of product's content that suitable for one meal.

3. If this product was on sale, how often will you consume it?

Response	Percent
More than one meal a day	5
One meal a day	34
2-3 times a week	25
Once a week	8
2-3 times a month	6
Once a month	4
Less than once a month	6
No response	12

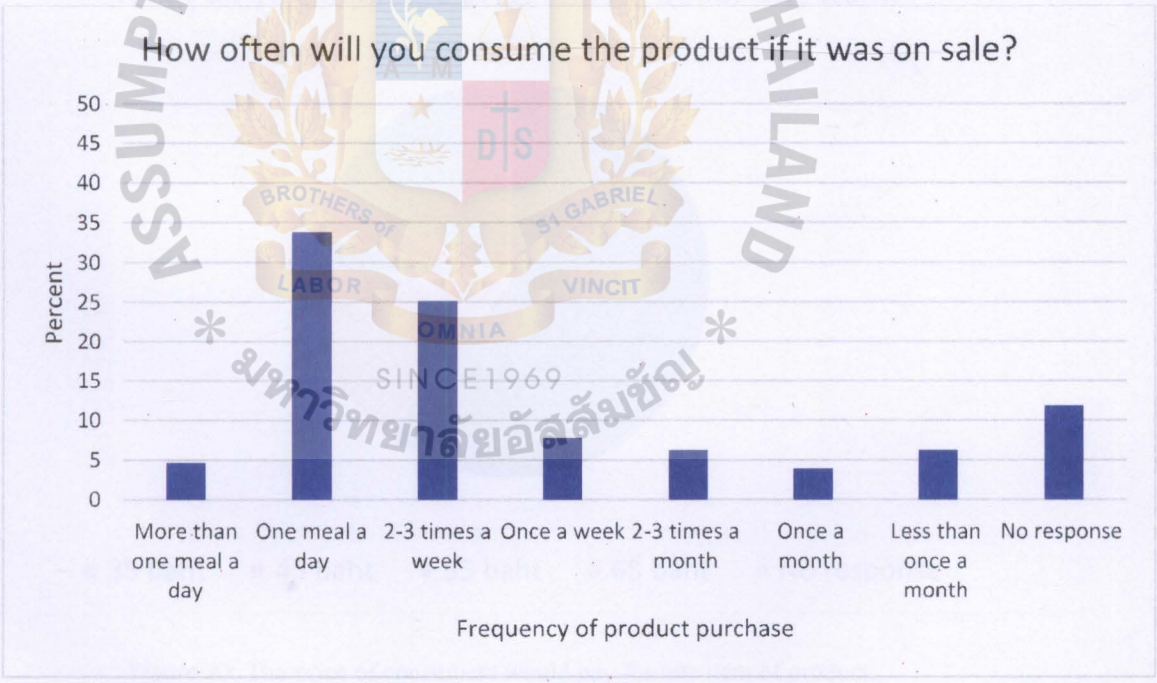


Figure 19: The effect of product sale on buying decision.

4. What do you think the price of product should be for one item?

Response	Percent
35 baht	61
45 baht	13
55 baht	3
65 baht	3
No response	18

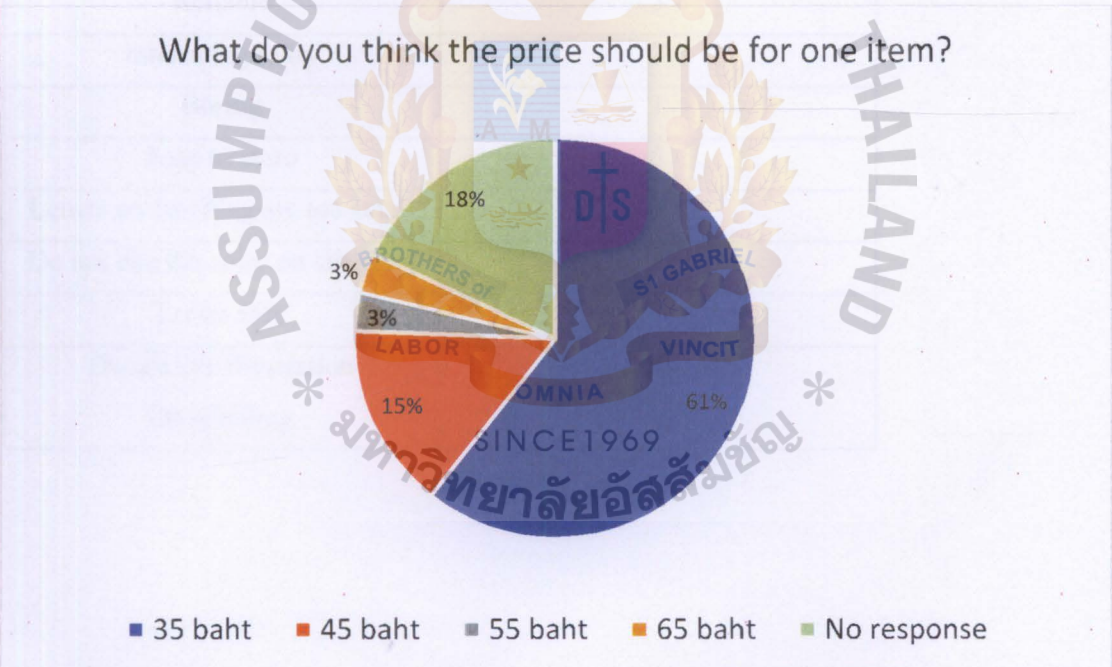


Figure 20: The price of consumers would pay for one item of product.

5. What do you think about this packaging?

Response	Percent
Labelling is easy to read	14
Convenience	8
Easy to open	6
Labelling is colorful	10
Interesting to buy	5
Hard to read labelling	3
Information is interesting	2
Not interesting	0.2
Look unsafe	2
Modern	10
Reliable	3
Interesting to try	7
Boring	1
Easy to store	5
Letters on labelling are too small	4
Do not like the color on labelling	1
Looks safe	8
Do not like illustration On labelling	0.5

Figure 21: The feedback on packaging design.

Figure 21: The feedback on packaging design.

Consumer Test (Part III: Demographics of Participated Individuals)

1. Gender

Gender	Percent
Female	46
Male	50
No response	5

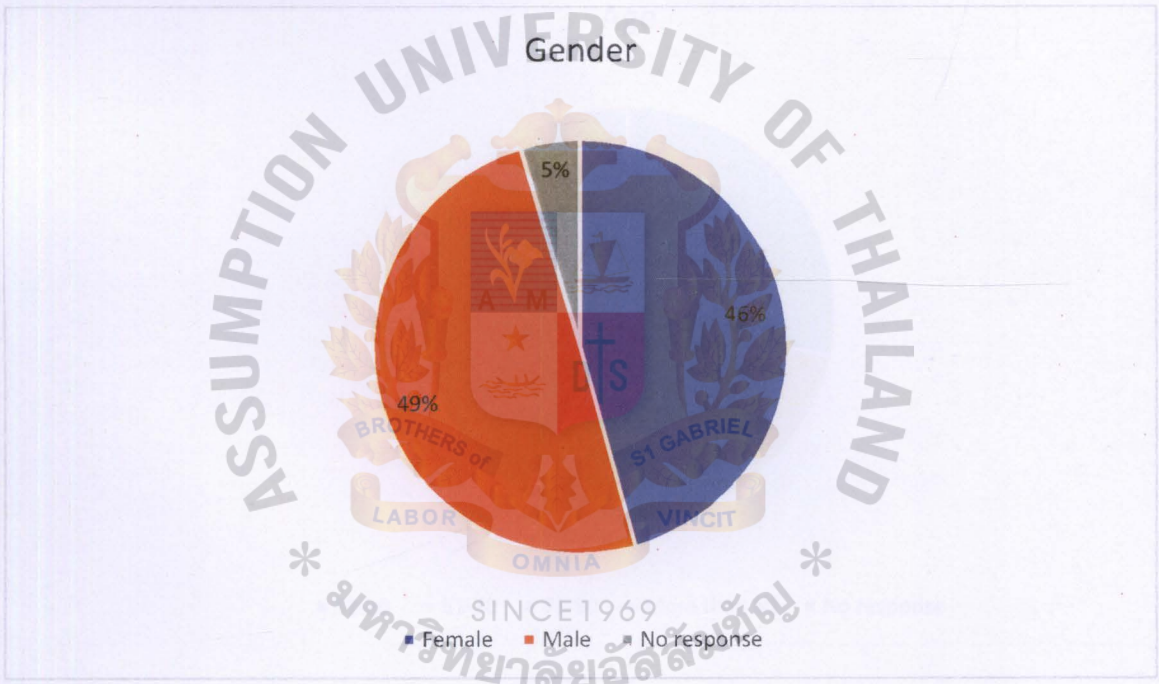


Figure 22: Gender percent of consumers.

2. Age

Response	Percent
51-60	28
61-70	30
71-80	25
More than 80	9
No response	8

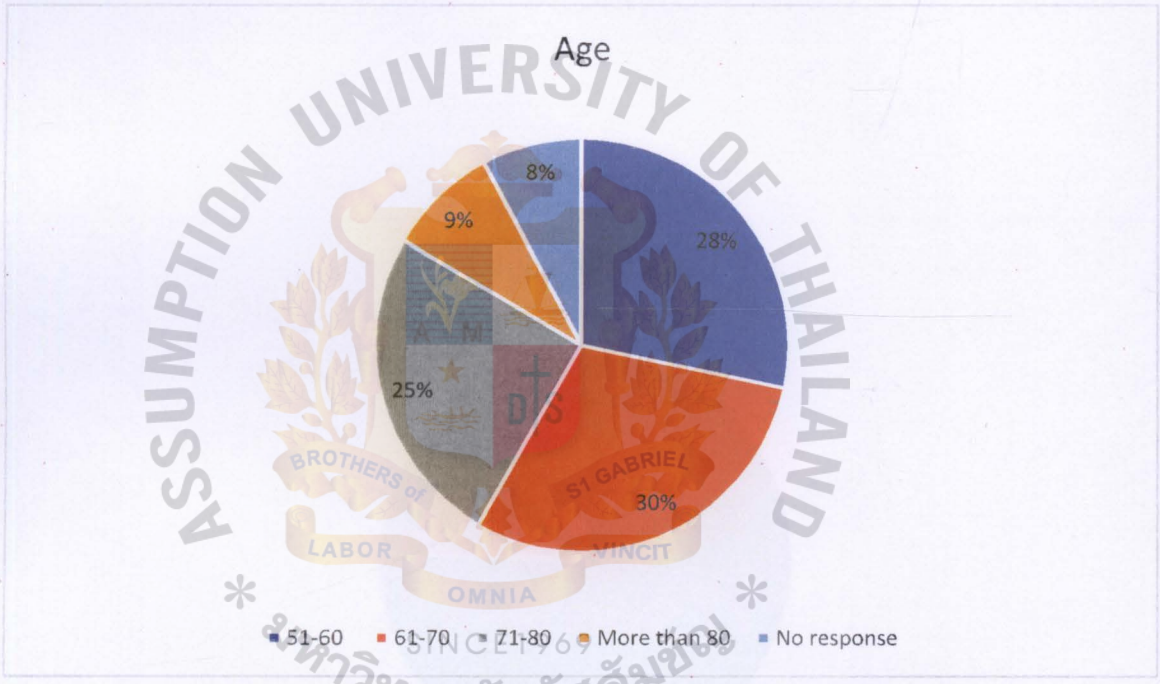


Figure 23: Age range of consumers.

3. Education level

Response	Percent
Lower than high school	53
High school	6
diploma	4
Bachelor or higher	8
No response	29

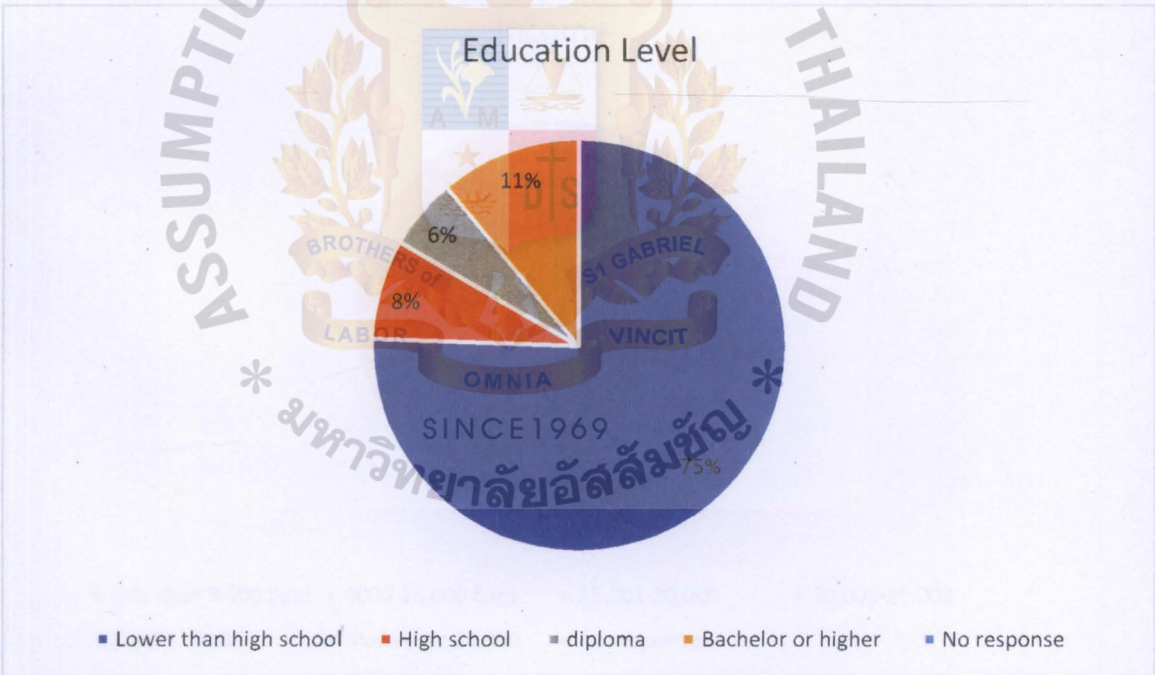


Figure 24: Education level of consumers.

4. Income

Response	Percent
Less than 9,000 baht	72
9000-15,000 baht	4
15,001-20,000	2
20,001-25,000	4
25,001- 30,000	0
More than 30,000	4
No response	18

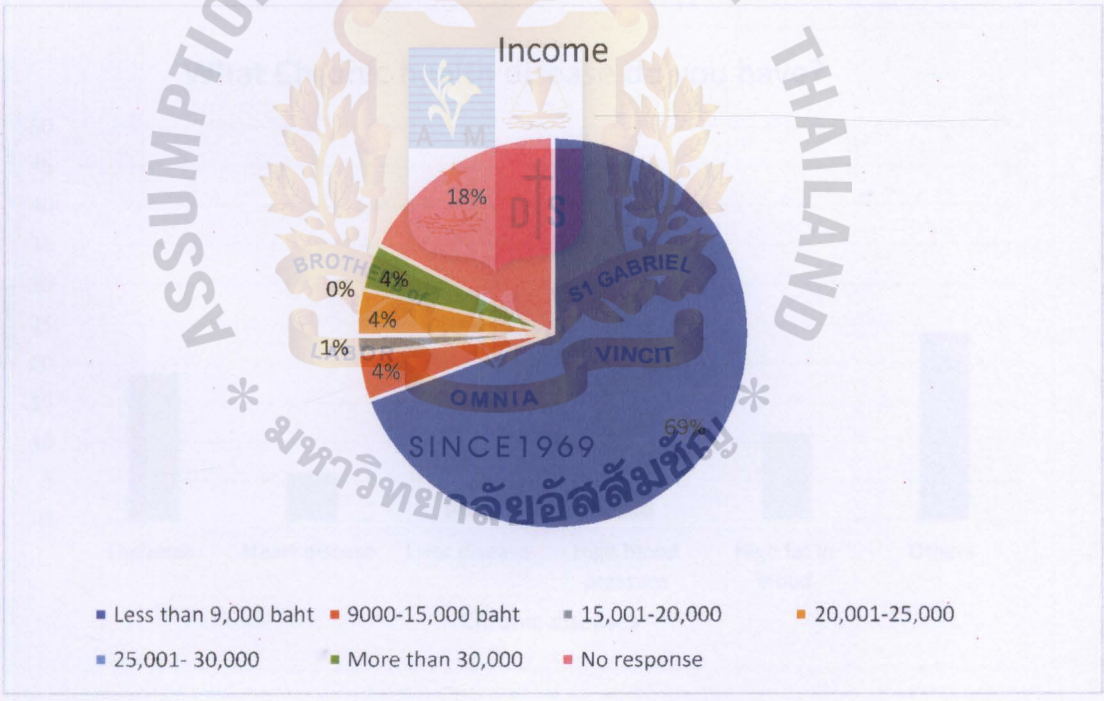


Figure 25: Income Range of consumers.

5. What chronic health disease do you have?

Response	Percent
Diabetes	19
Heart disease	6
Liver disease	3
High blood pressure	38
High fat in blood	11
Others	24

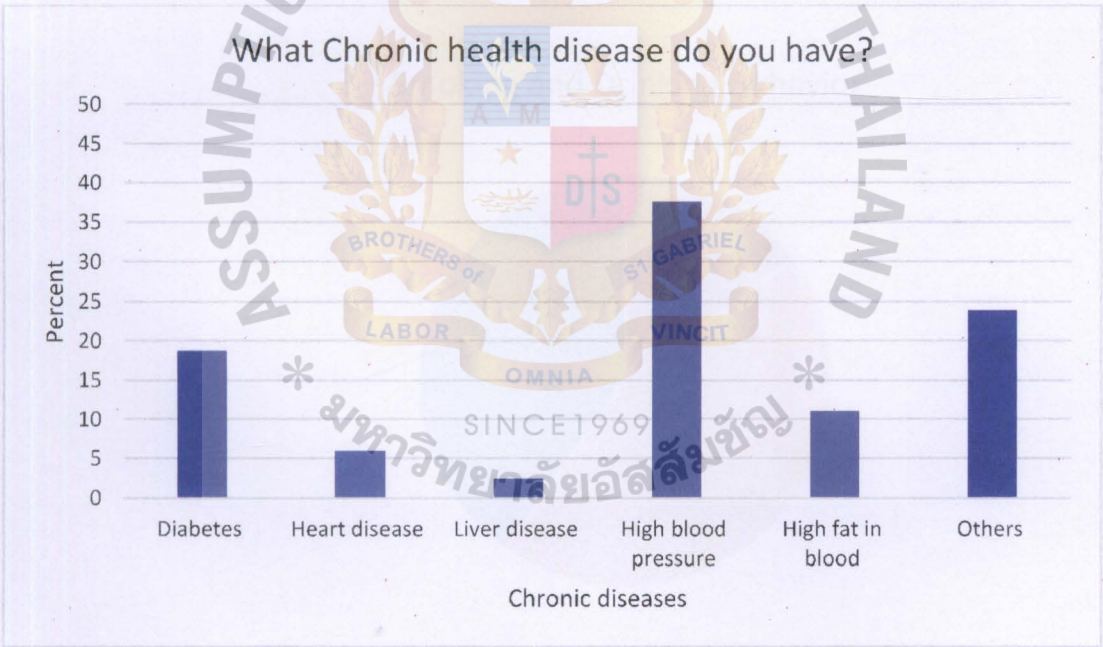


Figure 26: The percent of different chronic disease that participated consumers have.

6. Do you have the following behavior?

Response	Percent
Smoking	8
Drinking	1
Both	6
Neither smoke nor drink	45
No response	40

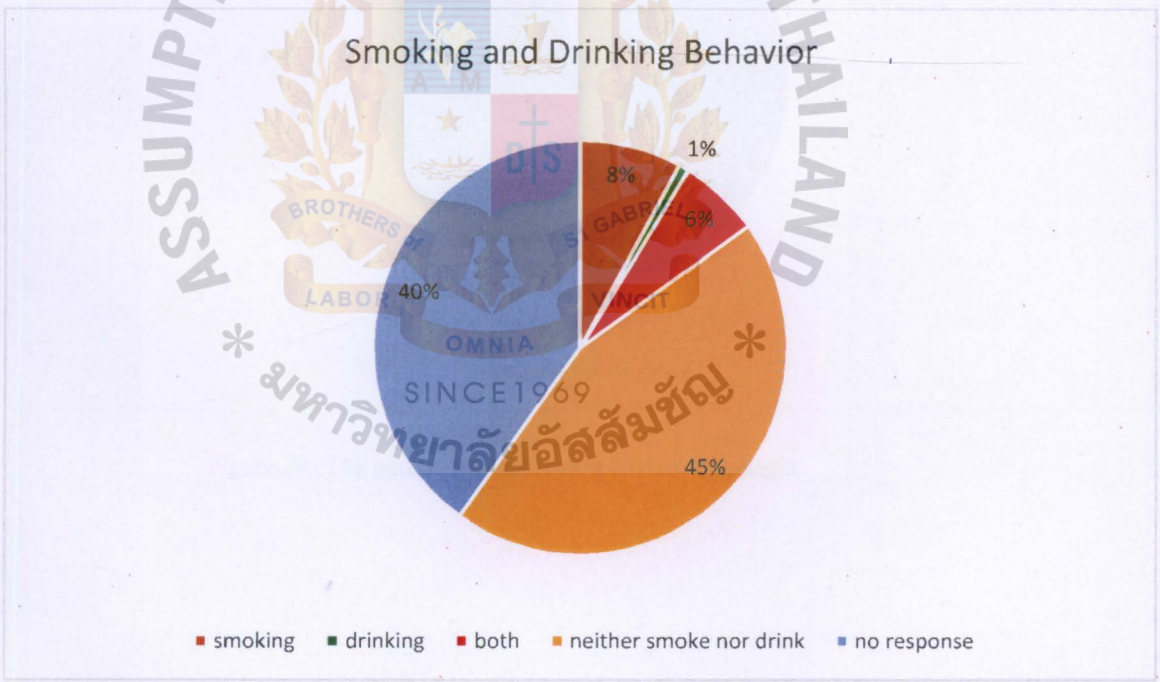


Figure 27: The percent of behavior of participated consumers.

Table 26: Result of disturbance swallowing questionnaire.

Dysphagia	Percent
Positive	97
Negative	3

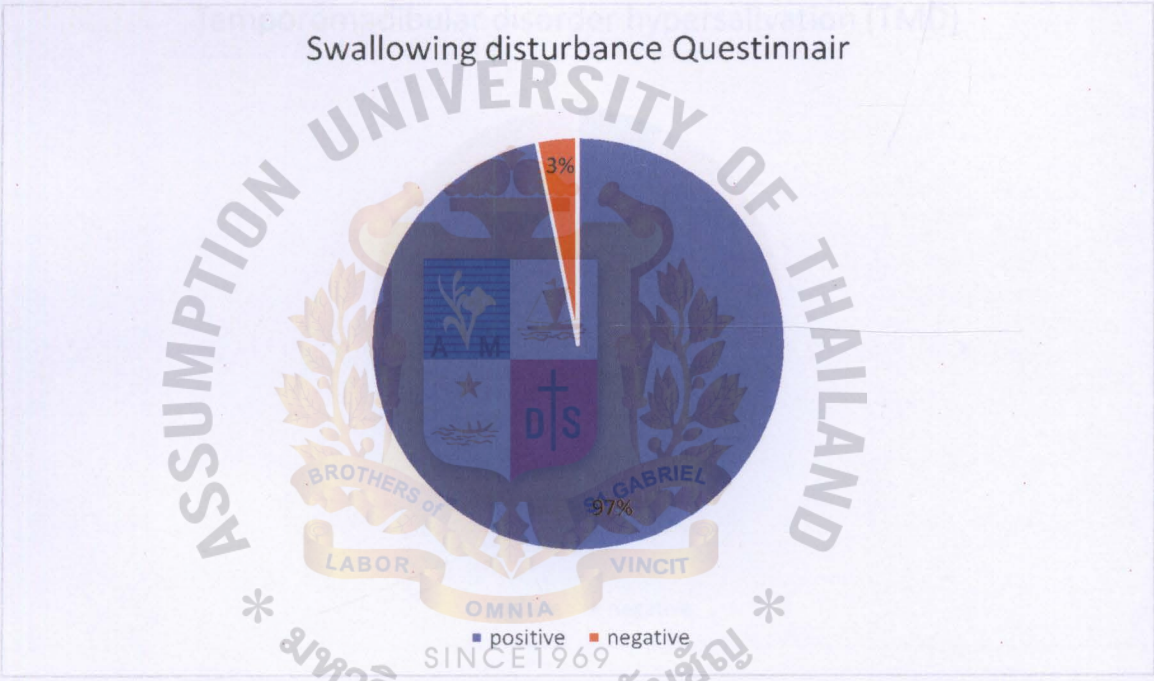


Figure 28: The percent of signalizing having dysphagia.

Table 27: Result of temporomandibular disorder hypersalivation questionnaire.

TMD	Percent
Positive	7
Negative	93

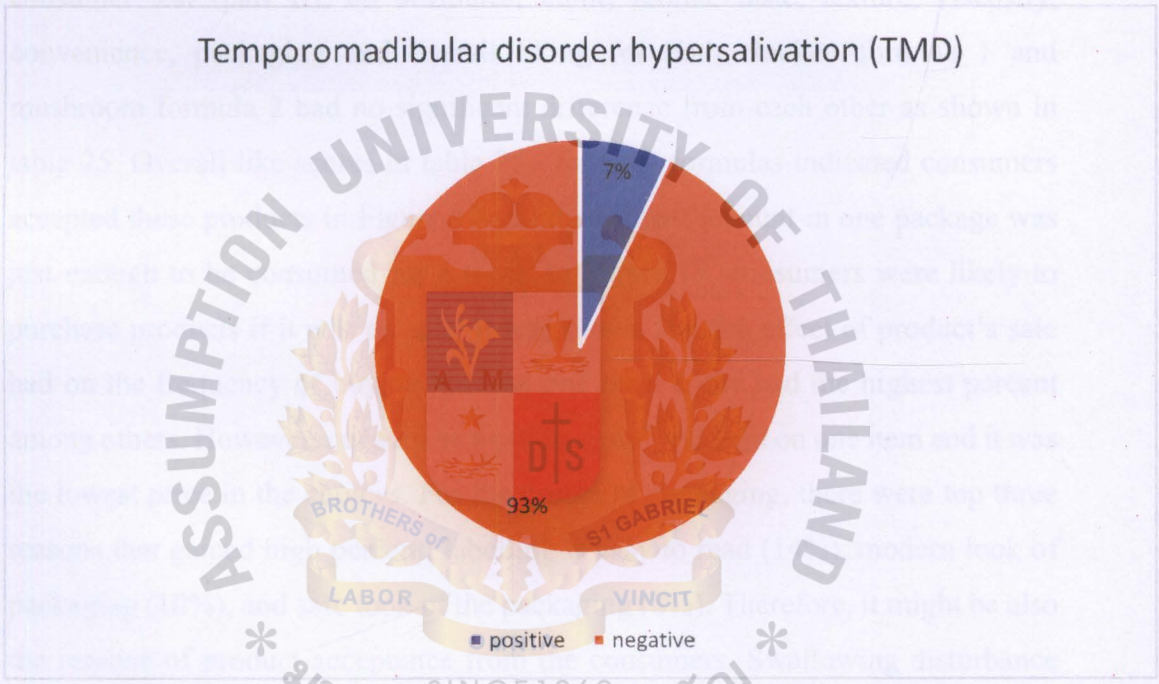


Figure 29: The percent of having or not having TMD.

In this consumer test both female 46% and 50% of male consumers and it had almost equal number of both genders were participated. They had the age range from 51 to more than 80 but age range from 51 to 80 were the highest number of participated consumers. Most of them (53%) had education level of lower than high school. In this age range of consumers (51 to more than 80), more than half of them had the income less than 9,000 baht. Diabetes and high blood pressure were the diseases that high number of consumers would have. Over half of them had drinking behavior which illustrated the percent in Figure 27. Those are the common diseases that could be found in people with age over 50. According to the consumer

test (part I) result the frequency of having meals in a day are 3 times as Figure 7 illustrated that the percent of 3 meals a day was the highest (86%). Moreover, consumers will buy meals on themselves and cook for themselves (55%). They would spend roughly 50-100 baht on a meal (61%) and wet market is the location where consumer buy foods the most (53.93%) for everyday (54%) when food is finished (76%). No sugar or low sugar product (24%) for consumers to buy the best as it scored the most compared to other kinds of product and the products which has bland taste was the most popular the consumers would like (36%). In consumer test (part II), all attributes; color, aroma, taste, texture, viscosity, convenience, packaging and overall liking for both chicken formula 1 and mushroom formula 2 had no significant difference from each other as shown in table 25. Overall like scores in table 25, for both formulas indicated consumers accepted these products in Figure 17 and the content amount in one package was just enough to be consumed for a meal. In Figure 19, consumers were likely to purchase products if it was on sale. It was shown that the effect of product's sale had on the frequency of buying because one meal a day had the highest percent among others. However, consumers would pay only 35 baht on one item and it was the lowest price in the choices. For the design of packaging, there were top three reasons that gained high percent; labelling is easy to read (14%), modern look of packaging (10%), and safe look of the packaging (8%). Therefore, it might be also the reasons of product acceptance from the consumers. Swallowing disturbance questionnaire was used to detect the risk of having dysphagia. 97% of participated consumers in Table 26, signalized the positive sign of having dysphagia as individuals presented the final score higher or equal to 11[20]. In contrast, 92% of individuals showed negative trace of having temporomandibular disorder hyposalivation or hypersalivation (TMD) in Table 27, which is the disorder movement of jaw, salivation secretion, and jaw muscle. This percent could tell or indicate that participated individuals had no trouble with chewing or masticating during the consuming of product.

Figure 30: Final look of products

Conclusion

This range of viscosity of the samples in the research has proved that it is suitable for people dysphagia to swallow that follow the standard of National Dysphagia Diet Task Force (2002)[24]. However, nutrition profiles have not met the standard nutrition that can provide adequate nutrition for one elderly person. There are several reasons of nutrition loss but the main reason was due to high liquid amount was added to the product. Somehow, there are some variation between estimated and actual nutrition value. However the overall of product's quality was accepted by consumers. With the supporting result of consumer test, this product might help to increase food choice for people with dysphagia. Further works are still needed to conduct in order to ensure the actual standard maximum range of viscosity that might be estimated for mass production. Nutritional value such as macronutrients and micronutrients might need to be determined in order to ensure that the product can provide adequate nutritional value for elder adults' nutrition intake

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Appendix A

Media Preparation

1. Brewer's Thioglycolate Broth

Cooked meat medium (1 tube)	1.5 g
Distilled water	9 mL

Suspend medium in 9 mL of distilled water. Sterilize by autoclaving at 15 lbs pressure (121°C) for 15 min.

2. Dextrose Tryptone Bromocresol Purple Broth

Tryptone	8 g
Peptone	2 g
Dextrose	5 g
Bromocresol Purple	0.04 g
Distilled water	1000 mL

Suspend all components in 1000 mL of distilled water. Mix thoroughly. Heat with frequent agitation and boil for 1 min to completely dissolve the powder. Autoclave at 121°C for 15 min.

3. Sulfide Agar

Sulfide agar medium	31 g
Distilled water	1000 mL

Suspend all components in 1000 mL of distilled water. Mix thoroughly. Heat with frequent agitation and boil for 1 min to completely dissolve the powder. Autoclave at 121°C for 15 min.

Appendix B

Sensory and Consumer Test Ballots

Sample: .....

aนเลขประจำตัวผู้บริโภค..... ..... : ..... วันที่ ..... : ....

คำชี้แจง กรุณาชิมตัวอย่างผลิตภัณฑ์โจ๊กข้าวไรซ์เบอร์รี่สำหรับผู้สูงอายุ หรือผู้มีปัญหาในการกลืน โดยชิมตัวอย่างจากซ้ายไปขวา แล้วเห็นให้คะแนนความชอบตรงตามความรู้สึกของท่าน และกรุณาดื่มน้ำระหว่างตัวอย่าง

โดยคะแนน 1 – ไม่ชอบมากที่สุด 2 - ไม่ชอบมาก 3 - ไม่ชอบปานกลาง
4 – ไม่ชอบเล็กน้อย 5 – เฉยๆ บอกไม่ได้ว่าชอบหรือไม่ชอบ 6 - ชอบเล็กน้อย
7 - ชอบปานกลาง 8 - ชอบมาก 9 – ชอบมากที่สุด

หลังจากนั้นกรุณาทำเครื่องหมาย X ลงในช่องที่ท่านเห็นว่าเหมาะสม สำหรับความเข้มของลักษณะต่างๆ

รหัสตัวอย่าง .....

คุณลักษณะ คะแนนความชอบ

1. ความชอบรวม _____

2. ความข้น _____

เหลวเกินไปอย่างมาก	เหลวเกินไปเล็กน้อย	ข้นพอดีแล้ว	✓ข้นเกินไปเล็กน้อย	ข้นมากเกินอย่างมาก

3. รสเค็ม _____

เค็มน้อยเกินมาก	เค็มน้อยเกินไปเล็กน้อย	เค็มพอดีแล้ว	เค็มมากเกินไปเล็กน้อย	เค็มมากเกินมาก

4. กลิ่นรสเครื่องเทศ _____

กลิ่นรสน้อยเกินมาก	.....น้อยเกินไปเล็กน้อย	พอดีแล้ว	.....มากเกินไปเล็กน้อย	.....มากเกินมาก

Sample: .....

รหัสตัวอย่าง .....

คุณลักษณะ

คะแนนความชอบ

1. ความชอบรวม _____

2. ความข้น _____

เหลวเกินไปอย่างมาก	เหลวเกินไปเล็กน้อย	ข้นพอดีแล้ว	ข้นเกินไปเล็กน้อย	ข้นมากเกินอย่างมาก

3. รสเค็ม _____

เค็มน้อยเกินมาก	เค็มน้อยเกินไปเล็กน้อย	เค็มพอดีแล้ว	เค็มมากเกินไปเล็กน้อย	เค็มมากเกินมาก

4. กลิ่นรสเครื่องเทศ _____

กลิ่นรสน้อยเกินมาก	.....น้อยเกินไปเล็กน้อย	พอดีแล้ว	.....มากเกินไปเล็กน้อย	.....มากเกินมาก

จากการชิมตัวอย่างทั้งสองตัวอย่าง ท่านชอบตัวอย่างไหนมากกว่ากัน

กรุณาเขียนรหัสตัวอย่างที่ท่านชอบมากกว่า ....

ข้อคิดเห็นอื่นๆ

.....

.....

.....

.....

เลขประจำตัวผู้บริโภค..... วันที่ .....

คำชี้แจง กรุณาชิมตัวอย่างผลิตภัณฑ์โจ๊กข้าวไรซ์เบอร์รี่สำหรับผู้สูงอายุ หรือผู้มีปัญหาในการกลืน โดยชิมตัวอย่างจากซ้ายไปขวา แล้วเห็นให้คะแนนความชอบตรงตามความรู้สึกของท่าน และกรุณาดื่มน้ำระหว่างตัวอย่าง

โดยคะแนน 1 – ไม่ชอบมากที่สุด 2 - ไม่ชอบมาก 3 - ไม่ชอบปานกลาง
4 – ไม่ชอบเล็กน้อย 5 – เฉยๆ บอกไม่ได้ว่าชอบหรือไม่ชอบ 6 - ชอบเล็กน้อย
7 - ชอบปานกลาง 8 - ชอบมาก 9 – ชอบมากที่สุด

หลังจากนั้นกรุณาทำเครื่องหมาย X ลงในช่องที่ท่านเห็นสาเหมาะสม สำหรับความเข้มของลักษณะต่างๆที่ท่านได้รับจากตัวอย่าง

รหัสตัวอย่าง .....

คุณลักษณะ คะแนนความชอบ

1. ความชอบรวม _____

2. ความข้น _____

ข้นน้อยเกินมาก	ข้นน้อยเกินไปเล็กน้อย	พอดีแล้ว	ข้นมากเกินไปเล็กน้อย	ข้นมากเกินมาก

3. รสเค็ม _____

เค็มน้อยเกินมาก	เค็มน้อยเกินไปเล็กน้อย	พอดีแล้ว	เค็มมากเกินไปเล็กน้อย	เค็มมากเกินมาก

4. กลิ่นรสเครื่องเทศน์ _____

กลิ่นรสเครื่องเทศน์อ่อนเกินมาก	กลิ่นรสเครื่องเทศน์อ่อนเกินไปเล็กน้อย	พอดีแล้ว	กลิ่นรสเครื่องเทศน์ฉุนเกินไปเล็กน้อย	กลิ่นรสเครื่องเทศน์ฉุนเกินมาก

เลขประจำตัวผู้บริโภค..... วันที่ .....

คำชี้แจง กรุณาชิมตัวอย่างผลิตภัณฑ์โจ๊กข้าวไรซ์เบอร์รี่สำหรับผู้สูงอายุ หรือผู้มีปัญหาในการกลืน โดยชิมตัวอย่างจากซ้ายไปขวา แล้วเห็นให้คะแนนความชอบตรงตามความรู้สึกของท่าน และกรุณาดื่มน้ำระหว่างตัวอย่าง

โดยคะแนน 1 – ไม่ชอบมากที่สุด 2 - ไม่ชอบมาก 3 - ไม่ชอบปานกลาง
4 – ไม่ชอบเล็กน้อย 5 – เฉยๆ บอกไม่ได้ว่าชอบหรือไม่ชอบ 6 - ชอบเล็กน้อย
7 - ชอบปานกลาง 8 - ชอบมาก 9 – ชอบมากที่สุด

คุณลักษณะ	รหัสตัวอย่าง		
	.....	.....	.....
ความชอบรวม (Overall liking)			
ลักษณะปรากฏโดยรวม (Overall appearance)			
ลักษณะด้านเนื้อสัมผัส (Texture Characteristics)			
รสชาติโดยรวม (Taste)			
กลิ่นรสโดยรวมของผลิตภัณฑ์ (Overall flavor)			

กรุณาเรียงลำดับความชอบที่มีต่อผลิตภัณฑ์ โดย โดยเขียนรหัสตัวอย่างหลังตัวเลข 1 2 3 ตามความคิดเห็นของท่าน

1 – ชอบมากที่สุด : .....

2 – ชอบรองลงมา : .....

3 – ชอบน้อยที่สุด : .....

ความคิดเห็นอื่น:

.....

.....

.....

.....

เลขประจำตัวผู้บริโภค..... วันที่ .....

คำชี้แจง กรุณาชิมตัวอย่างผลิตภัณฑ์โจ๊กข้าวไรซ์เบอร์รี่สำหรับผู้สูงอายุ หรือผู้มีปัญหาในการกลืน โดยชิมตัวอย่างจากซ้ายไปขวา แล้วเห็นให้คะแนนความชอบตรงตามความรู้สึกของท่าน และกรุณาดื่มน้ำระหว่างตัวอย่าง

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7 - ชอบปานกลาง 8 - ชอบมาก 9 - ชอบมากที่สุด

คุณลักษณะ	รหัสตัวอย่าง	รหัสตัวอย่าง .....
ความข้นของผลิตภัณฑ์ เมื่อบีบออกจากบรรจุภัณฑ์ (Viscosity: when squeeze sample out of packaging)		
ลักษณะปรากฏ (Appearance)		
รสชาติโดยรวม (Overall taste)		
กลิ่นรสโดยรวม (Overall flavor)		
ความข้นของผลิตภัณฑ์ เมื่อรับประทาน (Viscosity: during eating)		
ความชอบรวม (Overall liking)		

ท่านมีความคิดเห็นกับบรรจุภัณฑ์ที่ใช้กับผลิตภัณฑ์อย่างไร (What do you think about the package of these products?)

☐ ชอบ (I like it) เพราะ (because) .....

☐ เฉยๆ (neither like nor dislike)

☐ ไม่ชอบ (I do not like it) เพราะ (because) .....

เลขประจำตัวผู้บริโภค..... .....รส ..... วันที่ .....

แบบสอบถามการยอมรับผลิตภัณฑ์โจ๊กข้าวไรซ์เบอรรี่สำหรับผู้สูงอายุหรือผู้มีปัญหาในการเคี้ยวกลืน

คำแนะนำ: (แบบสอบถามมีทั้งหมด 3 หน้า)

1. แบบสอบถามนี้จัดทำขึ้นเพื่อใช้เป็นแนวทางพัฒนาผลิตภัณฑ์อาหารข้าวบดพร้อมรับประทานเพื่อผู้สูงอายุที่อาจมีปัญหาในการเคี้ยวและการกลืนอาหาร

2. แบบสอบถามนี้จัดทำเพื่ออาสมัครที่มีอายุ 50 ปี ขึ้นไป หรือ ผู้ที่มีปัญหาเคี้ยวกลืนทุกกลุ่มช่วงอายุ

3. โปรดเลือกตอบคำถามพฤติกรรมตามความเป็นจริง และสามารถเลือกได้มากกว่า 1 คำตอบ

4. ข้อมูลที่ท่านตอบจะถูกเก็บเป็นความลับ และใช้เพื่อการวิจัยเท่านั้น โดยไม่มีผลกระทบใดๆต่อการรักษาของท่าน และท่านสามารถพักการตอบแบบสอบถามได้ทุกเมื่อ

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ส่วนที่ 1 พฤติกรรมผู้บริโภค

1. ท่านรับประทานอาหารวันละกี่มื้อ ☐ 1 มื้อ ☐ 2 มื้อ ☑ 3 มื้อ ☐ อื่นๆ.....

2. ท่านเป็นคนตัดสินใจในการซื้ออาหารเองหรือไม่

☐ ตัดสินใจเอง ☐ ตัดสินใจเองร่วมกับผู้อื่น คือ.....

☐ ไม่ได้ตัดสินใจเอง ผู้รับผิดชอบในการซื้ออาหารของท่านคือ.....

3. ปกติท่านทำอาหารรับประทานเองหรือไม่

☐ ทำเอง ☐ ไม่ได้ทำเองและผู้รับผิดชอบในการเตรียมอาหารของท่านคือ.....

4. ท่านใช้จ่ายประมาณเท่าไรต่ออาหารหนึ่งมื้อ

☐ น้อยกว่า 50 บาท ☑ 50 – 100 บาท ☐ 101 – 150 บาท ☐ 151 – 200 บาท

☐ 201 – 250 บาท ☐ มากกว่า 250 บาท

5. ปกติแล้วท่านซื้ออาหารจากที่ไหน (ตอบได้มากกว่า 1 ข้อ)

☑ ตลาดสด ☐ ร้านอาหาร ☐ แผงอาหารทั่วไป ☐ ร้านสะดวกซื้อขนาดเล็ก (มินิมาร์ท)

☐ ซุปเปอร์มาร์เก็ต (เช่น Tops supermarket, Home fresh mart, Gourmet market)

☐ ไฮเปอร์มาร์เก็ต (เช่น บิ๊กซี แมคโคร เทสโก้โลตัส)

☐ ทางอินเตอร์เน็ต หรือจัดส่ง ☐ อื่นๆ (โปรดระบุ).....

6. ท่านซื้ออาหารบ่อยแค่ไหน

☐ ทุกวัน ☐ ทุกสัปดาห์ ☐ ทุก 2 สัปดาห์ ☐ เดือนละ 1 ครั้ง ☐ อื่นๆ .....

7. ท่านหรือบุคคลที่รับผิดชอบจัดซื้ออาหาร มักจะเดินทางไปซื้ออาหารเมื่อ (ตอบได้มากกว่า 1 ข้อ)

☐ อาหารหมด ☐ มีการจัดรายการส่งเสริมการขายลดราคา ☐ เมื่อพนักงานขายแนะนำ

☐ อื่นๆ .....

8. ท่านมักเลือกบริโภคผลิตภัณฑ์ที่มีลักษณะดังนี้ (ตอบได้มากกว่า 1 ข้อ)

☐ ไม่มีน้ำตาล หรือน้ำตาลน้อย ☐ ไม่มีไขมัน หรือไขมันน้อย ☐ ไม่มีคลอเลสเตอรอล

☐ โซเดียมต่ำ ☐ ไม่มีสารกันบูดหรือสารปรุงแต่งสังเคราะห์ ☐ ไม่มีผงชูรส

☐ พลังงานต่ำ ☐ มีผลิตภัณฑ์จากธรรมชาติ เช่น สมุนไพร ☐ ท่านรับประทานได้ทุกอย่าง

9. ท่านชื่นชอบอาหารที่มีรสชาติลักษณะใดเป็นรสเด่นนำ (ตอบได้มากกว่า 1 ข้อ)

☐ จืด ☐ เปรี้ยว ☐ หวาน ☐ เค็ม ☐ ขม ☐ เผ็ด ☐ อื่นๆ.....

ส่วนที่ 2 การทดสอบผู้บริโภค

คำชี้แจง กรุณาชิมตัวอย่างผลิตภัณฑ์โจ๊กข้าวไรซ์เบอร์รี่สำหรับผู้สูงอายุ หรือผู้มีปัญหาในการกลืน โดยชิมตัวอย่างจากซ้ายไปขวา แล้วเห็นให้คะแนนความชอบตรงตามความรู้สึกของท่าน และกรุณาดื่มน้ำระหว่างตัวอย่าง

โดยคะแนน 1 – ไม่ชอบมากที่สุด 2 - ไม่ชอบมาก 3 - ไม่ชอบปานกลาง

4 – ไม่ชอบเล็กน้อย 5 – เฉยๆ บอกไม่ได้ว่าชอบหรือไม่ชอบ 6 - ชอบเล็กน้อย

7 - ชอบปานกลาง 8 - ชอบมาก 9 – ชอบมากที่สุด

คุณลักษณะ	คะแนนความชอบ
	.....
สี	
กลิ่น	
รสชาติ	
เนื้อสัมผัส	
ความหนืด	
ความสะดวกในการรับประทาน	
บรรจุภัณฑ์	
ความชอบรวม	

1. ท่านยอมรับผลิตภัณฑ์นี้หรือไม่ ☐ ยอมรับ ☐ ไม่ยอมรับ

2. ปริมาณผลิตภัณฑ์นี้เหมาะสมกับ 1 มื้ออาหารหรือไม่

☐ น้อยเกินไป ☐ ขนาดพอเหมาะ ☐ มากเกินไป

3. หากมีผลิตภัณฑ์อาหารข้าวบดวางจำหน่าย ท่านจะเลือกรับประทานบ่อยเท่าใด

☐ มากกว่า 1 มื้อต่อวัน ☐ วันละมื้อ ☐ 2 - 3 ครั้งต่อสัปดาห์ ☐ สัปดาห์ละครั้ง

☐ 2 - 3 ครั้งต่อ เดือน ☐ สัปดาห์ละครั้ง ☐ น้อยกว่าสัปดาห์ละครั้ง

4. ท่านมีความคาดหวังเรื่องราคาของผลิตภัณฑ์อาหารข้าวบด เป็นราคาเท่าใดต่อมื้อบริโภค

☐ 35 บาท ☐ 45 บาท ☐ 55 บาท ☐ 65 บาท

5. ท่านมีความคิดเห็นอย่างไรเกี่ยวกับฉลากและบรรจุภัณฑ์ (เลือกได้มากกว่า 1 ข้อ)

☐ ฉลากอ่านง่าย ☐ บรรจุภัณฑ์ใช้สะดวก ☐ ง่ายต่อการเปิดรับประทาน

☐ ฉลากสีสดใส ☐ น่าซื้อ ☐ ฉลากอ่านยาก

☐ ข้อมูลบนฉลากน่าสนใจ ☐ ไม่น่าสนใจ ☐ ดูไม่ปลอดภัย

☐ ทันสมัย ☐ น่าเชื่อถือ ☐ น่าลองรับประทาน

☐ น่าเบื่อ ☐ ง่ายต่อการเก็บรักษา ☐ ตัวอักษรขนาดเล็กเกินไป

☐ ไม่ชอบสีที่ใช้บนฉลาก ☐ ดูปลอดภัย ☐ ไม่ชอบรูปที่ใช้

ข้อเสนอแนะเพิ่มเติม:

.....

.....

ส่วนที่ / ข้อมูลทางประชากรศาสตร์

1. เพศ ☐ ชาย ☐ หญิง

2. อายุ ☐ 51 - 60 ปี ☐ 61 - 70 ปี ☐ 71 - 80 ปี ☐ มากกว่า 80 ปี

3. ระดับการศึกษา ☐ ต่ำกว่ามัธยมศึกษา ☐ มัธยมศึกษา ☐ ปวช./ปวส. ☐ ปริญญาตรี หรือสูงกว่า

4. รายได้เฉลี่ยต่อหัวต่อเดือนภายในบ้านของท่าน (เช่น รายได้ 30,000 บาท ต่อเดือน มีสมาชิก 3 คน เท่ากับรายได้เฉลี่ย 10,000 บาทต่อหัวต่อเดือน)

☐ ต่ำกว่า 9,000 บาท ☐ 9,000 - 15,000 บาท ☐ 15,001 - 20,000 บาท

☐ 20,001 – 25,000 บาท ☐ 25,001 – 30,000 บาท ☐ มากกว่า 30,000 บาท

5. โรคประจำตัว (ตอบได้มากกว่า 1 ข้อ)

☐ เบาหวาน ☐ หัวใจ ☐ ไต ☐ ความดันโลหิตสูง

☐ ไขมันในเลือดสูง ☐ อื่นๆ .....

6. ท่านมีพฤติกรรมเหล่านี้หรือไม่ ☐ สูบบุหรี่ ☐ ดื่มเครื่องดื่มแอลกอฮอล์

แบบประเมินสภาวะการกลืนของผู้บริโภค

คำถาม	(0) ไม่เคยเลย	1 บางครั้ง (เดือนละครั้ง หรือน้อยกว่านั้น)	2 บ่อย (1-7 ครั้งต่อสัปดาห์)	3 บ่อยมาก (มากกว่า 7 ครั้งต่อสัปดาห์)
1. คุณมีประสบการณ์ความยากลำบากในการเคี้ยวอาหารที่เป็นของแข็ง เช่น แอปเปิ้ล ตุ๊กกี้ หรือ แครกเกอร์หรือไม่				
2. เมื่อเคี้ยวอาหารแล้วมีเศษอาหารเหลืออยู่ใน ปาก กระพุ้งแก้ม ใต้ลิ้น หรือ เพดานปากหรือไม่				
3. มีอาหารหรือของเหลวออกมาทางจมูกระหว่างคุณกินอาหารหรือดื่มเครื่องดื่มหรือไม่				
4. เมื่อคุณเคี้ยวอาหารเสร็จแล้วก่อนที่จะกลืน มีอาหารที่คุณเคี้ยวเสร็จแล้วมีไหลออกมาจากปากคุณหรือไม่				
5. คุณมีความรู้สึกคุณมีน้ำลายมากเกินไปหรือไม่ (คุณมีน้ำลายไหลออกมา หรือ มีความลำบากในการกลืนน้ำลายหรือไม่)				
6. เมื่อคุณเคี้ยวเสร็จแล้ว คุณต้องกลืนหลายครั้งก่อนที่อาหารจะไหลลงลำคอไปหรือไม่				
7. คุณมีความลำบากในการกลืนอาหารที่เป็นของแข็งหรือไม่ (แอปเปิ้ลหรือแครกเกอร์ติดคอคุณหรือไม่)				
8. คุณมีความลำบากในการกลืนอาหารที่เป็นของเหลวหรือไม่				
9. ระหว่างรับประทานอาหาร, คุณรู้สึกว่ามีอาหารติดคอหรือไม่				
10. คุณไอเมื่อคุณกลืนอาหารที่เป็นของเหลวหรือไม่				
11. คุณไอเมื่อคุณกลืนอาหารที่เป็นของแข็งหรือไม่				
12. ทันทีหลังจากที่กินอาหารหรือดื่มเครื่องดื่ม, คุณพบว่าเสียงของคุณเปลี่ยนไปหรือไม่ เช่น เสียงแหบแห้ง หรือ เสียงพล่า				
13. ในเวลาอื่นที่ไม่ใช่เวลารับประทานอาหาร, คุณมีอาการไอ หรือ มีความลำบากในการหายใจ เพราะว่ามีน้ำลายเข้าไปในหลอดลมหรือไม่.				
14. คุณมีความลำบากในการหายใจระหว่างรับประทานอาหารหรือไม่				
15. คุณเคยป่วยจากโรคที่เกี่ยวกับระบบหายใจ (เช่น ปอดบวม หลอดลมอักเสบ) ในปีที่ผ่านมาหรือไม่				

เลขประจำตัวผู้บริโภค..... วันที่.....

แบบประเมินสถาพะปัญหาในการบดเคี้ยวของผู้บริโภค

คำถาม	ใช่	ไม่ใช่
1. ท่านรู้สึกปวดขณะอ้าปาก หรือ อ้าปากลำบากหรือไม่ เช่น เวลาหาวนอน หรือเวลาเคี้ยวอาหาร		
2. ท่านมีอาการขากรรไกรค้างหรือติดขัดหรือไม่		
3. เคยมีขากรรไกรค้าง แต่เมื่อขยับคางซ้ายขวา ก็สามารถหุบลงได้เอง		
4 ท่านมีอาการปวดติดขัดเวลาเคี้ยวอาหาร พูด หรือ ขณะใช้ขากรรไกร		
5. ท่านได้ยินเสียงที่บริเวณข้อต่อขากรรไกรหรือไม่		
6. รู้สึกมีเสียง "คลิก" หรือ "เปาะ" ที่บริเวณข้อต่อขากรรไกร ขณะอ้าปากหรือหุบปากเคี้ยวอาหาร		
7. ท่านรู้สึกเมื่อย ตึง หรือลำบริเวณขากรรไกรหรือไม่		
8 ท่านมีอาการปวดในหู ขมับ หรือ แก้ม หรือไม่		
9. ท่านมีอาการปวดศีรษะ ปวดคอ หรือ ปวดฟันเป็นประจำหรือไม่		
10. ท่านได้รับบาดเจ็บบริเวณศีรษะ คอ หรือ ขากรรไกร เมื่อเร็วๆนี้หรือไม่		
11. ท่านรู้สึกว่าการสบของฟันท่านเปลี่ยนไปหรือไม่		
12. ท่านเคยได้รับการบำบัดรักษาความเจ็บปวดบริเวณใบหน้า หรือ ขากรรไกร หรือไม่		

Appendix C

SAS output

Comparing liking score chicken vs mushroom

The TTEST Procedure

Variable: color

trt	N	Mean	Std Dev	Std Err	Minimum	Maximum
Mushroom	37	6.2703	2.0365	0.3348	1.0000	9.0000
chicken	25	6.3200	1.6513	0.3303	3.0000	9.0000
Diff (1-2)		-0.0497	1.8918	0.4898		

trt	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
Mushroom		6.2703	5.5913	6.9493	2.0365	1.6561	2.6453
chicken		6.3200	5.6384	7.0016	1.6513	1.2894	2.2972
Diff (1-2)	**Pooled**	-0.0497	-1.0294	0.9300	1.8918	1.6056	2.3032
Diff (1-2)	**Satterthwaite**	-0.0497	-0.9911	0.8916			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	60	-0.10	0.9195
Satterthwaite	Unequal	57.905	-0.11	0.9161

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	36	24	1.52	0.2838

Variable: aroma

trt	N	Mean	Std Dev	Std Err	Minimum	Maximum
Mushroom	36	6.1389	1.8229	0.3038	2.0000	9.0000
chicken	25	6.3600	1.8000	0.3600	1.0000	8.0000
Diff (1-2)		-0.2211	1.8136	0.4722		

trt	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
Mushroom		6.1389	5.5221	6.7557	1.8229	1.4785	2.3779
chicken		6.3600	5.6170	7.1030	1.8000	1.4055	2.5041
Diff (1-2)	**Pooled**	-0.2211	-1.1659	0.7237	1.8136	1.5373	2.2120
Diff (1-2)	**Satterthwaite**	-0.2211	-1.1663	0.7241			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	59	-0.47	0.6413
Satterthwaite	Unequal	52.203	-0.47	0.6408

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	35	24	1.03	0.9653

Variable: taste

trt	N	Mean	Std Dev	Std Err	Minimum	Maximum
Mushroom	39	6.1282	1.7195	0.2753	3.0000	9.0000
chicken	25	6.4800	1.7588	0.3518	1.0000	9.0000
Diff (1-2)		-0.3518	1.7348	0.4445		

trt	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
Mushroom		6.1282	5.5708	6.6856	1.7195	1.4053	2.2161
chicken		6.4800	5.7540	7.2060	1.7588	1.3733	2.4467
Diff (1-2)	**Pooled**	-0.3518	-1.2403	0.5367	1.7348	1.4760	2.1046
Diff (1-2)	**Satterthwaite**	-0.3518	-1.2488	0.5452			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	62	-0.79	0.4317
Satterthwaite	Unequal	50.457	-0.79	0.4347

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	24	38	1.05	0.8812

Variable: texture

trt	N	Mean	Std Dev	Std Err	Minimum	Maximum
Mushroom	39	6.0000	1.7770	0.2846	2.0000	9.0000
chicken	25	6.5200	1.3266	0.2653	2.0000	9.0000
Diff (1-2)		-0.5200	1.6176	0.4144		

trt	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
Mushroom		6.0000	5.4239	6.5761	1.7770	1.4523	2.2902
chicken		6.5200	5.9724	7.0676	1.3266	1.0359	1.8456
Diff (1-2)	Pooled	-0.5200	-1.3485	0.3085	1.6176	1.3763	1.9625
Diff (1-2)	Satterthwaite	-0.5200	-1.2981	0.2581			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	62	-1.25	0.2143
Satterthwaite	Unequal	60.45	-1.34	0.1864

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F

Variable: vis

trt	N	Mean	Std Dev	Std Err	Minimum	Maximum
Mushroom	37	5.7838	2.0019	0.3291	1.0000	9.0000
chicken	25	6.1200	1.8556	0.3711	2.0000	9.0000
Diff (1-2)		-0.3362	1.9447	0.5035		

trt	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
Mushroom		5.7838	5.1163	6.4512	2.0019	1.6279	2.6004
chicken		6.1200	5.3540	6.8860	1.8556	1.4489	2.5815
Diff (1-2)	Pooled	-0.3362	-1.3433	0.6709	1.9447	1.6505	2.3675
Diff (1-2)	Satterthwaite	-0.3362	-1.3306	0.6582			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	60	-0.67	0.5068
Satterthwaite	Unequal	54.231	-0.68	0.5008

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	36	24	1.16	0.7065

Variable: con

trt	N	Mean	Std Dev	Std Err	Minimum	Maximum
Mushroom	39	7.0000	1.9467	0.3117	2.0000	9.0000
chicken	25	7.2000	1.6330	0.3266	2.0000	9.0000
Diff (1-2)		-0.2000	1.8316	0.4693		

trt	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
Mushroom		7.0000	6.3690	7.6310	1.9467	1.5909	2.5088
chicken		7.2000	6.5259	7.8741	1.6330	1.2751	2.2717
Diff (1-2)	**Pooled**	-0.2000	-1.1381	0.7381	1.8316	1.5583	2.2221
Diff (1-2)	**Satterthwaite**	-0.2000	-1.1039	0.7039			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	62	-0.43	0.6714
Satterthwaite	Unequal	57.503	-0.44	0.6594

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	38	24	1.42	0.3666

Variable: pkg

trt	N	Mean	Std Dev	Std Err	Minimum	Maximum
Mushroom	39	7.3077	1.7191	0.2753	2.0000	9.0000
chicken	25	7.4400	1.4166	0.2833	3.0000	9.0000
Diff (1-2)		-0.1323	1.6088	0.4122		

trt	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
Mushroom		7.3077	6.7504	7.8650	1.7191	1.4050	2.2156
chicken		7.4400	6.8553	8.0247	1.4166	1.1061	1.9707
Diff (1-2)	**Pooled**	-0.1323	-0.9562	0.6916	1.6088	1.3687	1.9517
Diff (1-2)	**Satterthwaite**	-0.1323	-0.9230	0.6584			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	62	-0.32	0.7493
Satterthwaite	Unequal	58.037	-0.33	0.7389

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	38	24	1.47	0.3194

Variable: ol

trt	N	Mean	Std Dev	Std Err	Minimum	Maximum
Mushroom	31	7.0968	1.5568	0.2796	1.0000	9.0000
chicken	25	7.0800	1.4697	0.2939	1.0000	8.0000
Diff (1-2)		0.0168	1.5187	0.4082		

trt	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
Mushroom		7.0968	6.5257	7.6678	1.5568	1.2441	2.0809
chicken		7.0800	6.4733	7.6867	1.4697	1.1476	2.0446
Diff (1-2)	Pooled	0.0168	-0.8017	0.8352	1.5187	1.2785	1.8708
Diff (1-2)	Satterthwaite	0.0168	-0.7971	0.8306			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	54	0.04	0.9674
Satterthwaite	Unequal	52.618	0.04	0.9672

Equality of Variances

Method	Num DF	Den DF	F Value	Pr > F
Folded F	30	24	1.12	0.7799