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A Study on the Development of Healthy Desserts Using Plums

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Abstract

The health of modern people is threatened by bad eating habits. In order to provide healthy desserts to people, we conducted a study on adding plum concentrate, which is effective for fatigue recovery, insomnia, and prevention of constipation, to scones. In order to examine the utility of scones made by adding plum concentrate, the following experiment was conducted. It was prepared by adding 0g, 3g, 5g, and 7g of plum concentrate to the scone dough, respectively. As a result of the test, the sensory characteristic value was the highest in the experimental group to which 5 g of plum concentrate was added (4.77). There was a significant difference in that the average value tended to increase as the concentration of the plum concentrate increased. As for fragrance, the experimental group with the addition of 5 g of plum concentrate showed the highest sensory characteristic value of 3.62, but there was no significant difference. The experimental group to which 3 g of plum concentrate was added showed higher preference than the control group in most items such as color, flavor, sweetness, and overall preference. This study suggests that the production of scones with plum concentrate has a high potential for commercial use.

Keywords: Plum Concentrate, Scones, Physical Properties, Quality Properties, Sensory Test

Major classifications: Food Nutrition, Healthy Food

1. Introduction

Recently, the health of modern people is under threat due to an increase in eating out, retort food intake, and wrong eating habits. Accordingly, interest in health functional foods is increasing. In order to regain the health lost due to unhealthy eating habits, people look for healthy food again, but the time of modern people does not keep up with eating healthy food all the time. However, various desserts using healthy ingredients can give our body healthy energy. Plum is recognized as a health food for fatigue recovery, antioxidant, chronic fatigue, and insomnia. The cultivated area of plums in Korea increased rapidly

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from 3,698 ha in 2005 to 7,773 ha in 2010, and the production increased to 45,000 tons in 2013. Plum is used for processing rather than reproduction due to its consumption characteristics, so problems such as falling prices due to overproduction are expected to inevitably occur in the current consumption type, and as a countermeasure, various consumption types are required to be discovered and processed (Kang, 2020). In Korea, plum trees with various characteristics have been distributed throughout the country for a long time, and many of them are reported to have historical significance along with the old age. Most of the currently cultivated plum tree varieties are those that have been nurtured recently, and many studies have been done on this. Therefore, research on these native plum resources is expected to provide useful information on the utilization potential of plums and contribute greatly to discovering new consumers (Kang, 2020).

2. Theoretical Background

2.1. Plum

2.1.1. Characteristics of plum

Plum is the fruit of the plum tree, and it is a fruit for processing that is difficult to distribute and reproduce. The plum is known to be a mountainous region of Sichuan and Hubei, China, and is widely distributed as a wild species in temperate regions such as Korea, China and Japan, which are in the northeastern part of Asia. It is presumed that the general route of propagation of plum trees was through China in Korea and through Korea in Japan. Plum is a fruit that can only be obtained from the end of May to mid-June of the year. It is mainly processed into plum wine, plum tea, pickled plum, plum extract, plum juice, plum vinegar, plum jap, etc. In particular, plum extract is widely used for cooking (Lee, 2002).

2.1.2. Efficacy of plum

Plums contain 4 times more calcium and 6 times more iron than apples. Plum is an alkaline food rich in organic acids and rutin. It contains a lot of citric acid and malic acid, so it prevents the accumulation of lactic acid in the body and relieves fatigue. Therefore, it is known to be effective for chronic fatigue and insomnia in modern people whose constitution is acidified, who consume a lot of processed foods such as meat and instant foods. Plum, which is known to increase the absorption of calcium in the body, contains various physiologically active substances, so it is highly effective in preventing various adult diseases caused by acidification of the human body. It is also effective for constipation as it is high in dietary fiber. There is a saying that the picric acid contained in the plum has a blood purification effect that washes away the poisons in 'food', 'blood' and 'water', so that the plum removes the three poisons. Plum consumption activates liver function, which is good for detoxification and hangover relief (Kim et al., 2004). In a study on the effect of plum extract intake on changes in energy substrate and fatigue substances, the accumulation of fatigue substances such as lactic acid, ammonia and inorganic phosphoric acid was reduced as a result of administering plum extract to adult males. It can be seen that the citric acid contained in plums delays glycogen depletion and induces to reduce the accumulation of fatigue substances by increasing the use of free fatty acids, resulting in the conclusion that the intake of plum extract has a positive effect (Paik et al., 2010).

2.1.3. Prior research on plum

Previous studies of plums include the following. In a study on the quality characteristics of cookies with Ulleung plum powder added, experiments were conducted by adding Ulleung plum powder at 0%, 1%, 2%, and 3%. The density of cookie dough and moisture content of cookies increased significantly as the amount of plum powder added increased, and the pH of cookie dough, cookie spreadability index, and cookie preference decreased significantly as the amount of plum powder added increased. In other words, this study indicates that adding up to 1% of Ulleung Plum powder to cookies can increase the functionality of cookies without affecting the taste (Kim, 2009). In a study on the quality characteristics of muffins according to the addition of pickled plum pulp, various quality characteristics were investigated by preparing muffins containing 0, 20, 40, and 60% of pickled plum pulp. As the pickled plum pulp was added, the moisture content increased, the weight of the muffin increased, and the crude protein, crude fat, ash content, and the volume and specific volume of the muffin decreased. As the addition amount increased, the brightness increased, and the redness and yellowness decreased. In the sensory test, the muffins added with 40% of pickled plum pulp had the highest preference, followed by 20% and 60% with the lowest preference (Lee, 2003). As a study on the comparison of the components of fermented plums with different varieties and sugar concentrations, fermented plums were prepared with different sugar concentrations of 60% and 100% using Namgo plum and Pungfu plum varieties. According to the results of the study reviewed after preparing the fermented broth, the moisture and solid content were lower as the amount of added sugar was higher, and the fermented plums were higher at 51.2% than in the

fermented Namgo plum (30.7%). As for the total polyphenol content, when comparing Namgo and Pungfu plum, 60% of sugar had a higher polyphenol content. In the sensory test, both 60% and 100% sugar received good ratings, especially when the sugar concentration of fermented Namgo plum juice was 60%. In other words, when the results of this experiment are summarized, it was found that the quality characteristics of the native Namgo plum had the best quality when the sugar concentration was 60% (Yun, 2010).

Experimental animals were divided on the antioxidant activity of physiologically active substances contained in plum. The study was conducted by dividing the normal group, the plum ethanol extract 200 mg/kg administration group, the alcohol-only administration group (35% ethanol 10 mL/kg, b.w./day), the alcohol and plum ethanol extract 200 mg/kg combined administration group, and the alcohol and plum ethanol extract 400 mg/kg combined administration group for 6 weeks. The indicator of liver damage rose with alcohol administration, but decreased with plum ethanol administration, and GSH-Px activity increased compared to the normal group with alcohol administration, and then GSH-Px activity increased with plum ethanol administration decreased close to the normal group. Plum ethanol extract increased the GSH content in liver tissue, which was reduced by alcohol administration. Plum ethanol extract was said to enhance the defense against lipid peroxide, and it is thought to have a recovery action against hepatocyte damage (Lee, 2002). A method to improve the storage properties of pickled plums subjected to heat treatment was studied. In a situation where plum-flavored seasonal foods are boiled by residual microorganisms during distribution and overflowing, experiments were conducted to find out the microorganisms that cause the boiling and overflowing phenomenon and to set optimal heat treatment conditions to suppress their growth. Gas generation by yeast of the genus *Candida*, which is an osmotic resistant yeast such as sugar and salt resistance, remaining in pickled plums, has become a problem. Yeasts of the genus *Candida* and the like are weak to heat, so by setting the conditions to heat treatment in hot water at 60°C for 30 minutes, it was possible to suppress the growth of residual microorganisms for a long period of time without significant change in plum hardness and improve storage properties (Kim, 2004). Antibacterial activity and bad breath suppression effect of natural products were studied. Among natural products, plum has excellent antioxidant and antibacterial properties, and citric acid in plum has a strong antibacterial action, which is known to have a sterilizing effect and promote salivation. The fragrance component of plum is benzaldehyde, terpinen-4-ol, benzyl alcohol, hexadecanoic acid, etc. When the plum extract is applied to the oral cavity, it is said that it is effective in suppressing bad breath in the oral cavity without causing chemical irritation or side effects. In the experiment, green tea, mint, wild pepper, and pine needles were added to plum, and bad breath was analyzed using a volatile sulfur compound analyzer Sensor Gas Chromatograph ODSA-P2 (FIS Inc., Hyogo Japan) for enzyme extraction and antibacterial testing. In the analysis, it can be seen that the inhibition rate of volatile sulfur compounds was derived from the same results as plum + green tea (91.92%) > plum + mint (75.83%) > plum + vinegar (72.17%) > plum (59.68%) > plum + pine leaf (34.16%). That is, through this study, it can be confirmed that the plum extract is effective in suppressing the microorganisms that cause oral disease, and in particular, it is most effective when mixed with plum and green tea (Hyun, 2016). A study was conducted on the quality characteristics of bread containing plum pulp, which is a by-product of plum liqueur manufacturing. The study was conducted to remove alcohol by immersing discarded plums in distilled water 3 times for 24 hours each, and then washing and enucleating them again 3 times. After preparation by addition, the quality characteristics were compared with the control group. As a result of the study, the pH decreased as the amount of plum added increased, the acidity increased, and the fermentation expansion power and baking loss rate of the dough decreased as the amount of plum added increased. In addition, as the amount of plum added increased, the weight of the bread added with plum flesh also increased, but the volume decreased. The L value was similar to the dough with 10% plum pulp and the control, and the dough with 20% plum pulp was significantly reduced compared to the control. It can be seen that the L value of the bread surface increased in the group with plum added than the control group. In the sensual test, the preference of the plum pulp 10% additive increased significantly compared to the control, but no significant difference was recognized in color, chewability, softness, and overall preference. On the other hand, the palatability of the bread added with 20% plum pulp was significantly decreased compared to the control group. In other words, it was judged that the quality of bread was not affected even when plums, a by-product generated during the manufacture of plum liqueur, were used in bread making because excellent results were obtained in the sensory test when 10% plum pulp was added (Chae et al., 2006).

A study was conducted on the optimization of product characteristics and manufacturing conditions of plum jelly. As a result of the experiment, sugar and gelatin had the greatest effect on water activity of plum jelly, and plum concentrate had the greatest effect on color. All items except for chewiness and elasticity showed differences depending on the material, and gelatin had the greatest effect. Hardness, cohesiveness, and compactness increased as the amount of gelatin increased, while viscosity decreased as the amount of gelatin increased. The sensory characteristics, firmness and elasticity, were affected by gelatin, and sweetness, amount of sugar, color, and flavor were affected by plum concentrate. As a result of synthesizing the contours of the sensory test values, the optimal range of manufacturing conditions for plum jelly was 12.9g for plum

concentrate, 126.7-132.9g for sugar, and 13.95-14.35g for gelatin. That is, through this study, it can be seen that the plum content affects the flavor more than the physical properties of the jelly, and people prefer a low gelatin concentration (Heo, & Han, 2005).

The antibacterial activity of plum concentrate was studied. This study was conducted to search for natural antibacterial materials that are harmless to the human body, and the antibacterial and antifungal activities against 5 food poisoning bacteria, 2 types of athlete's foot, and 2 types of plant pathogens were measured in the plum concentrate by the paper disc diffusion method. The study was conducted to remove alcohol by immersing discarded plums in distilled water 3 times for 24 hours each, and then washing and enucleating them again 3 times. After preparation by addition, the quality characteristics were compared with the control group. As a result of the study, the pH decreased as the amount of plum added increased, the acidity increased, and the fermentation expansion power and baking loss rate of the dough decreased as the amount of plum added increased. In addition, as the amount of plum added increased, the weight of the bread added with plum flesh also increased, but the volume decreased. The L value was similar to the dough with 10% plum pulp and the control, and the dough with 20% plum pulp was significantly reduced compared to the control. It can be seen that the L value of the bread surface increased in the group with plum added than the control group. In the sensual test, the preference of the plum pulp 10% additive increased significantly compared to the control, but no significant difference was recognized in color, chewability, softness, and overall preference. On the other hand, the palatability of the bread added with 20% plum pulp was significantly decreased compared to the control group. In other words, it was judged that the quality of bread was not affected even when plums, a by-product generated during the manufacture of plum liqueur, were used in bread making because excellent results were obtained in the sensory test when 10% plum pulp was added. A study was conducted on the optimization of product characteristics and manufacturing conditions of plum jelly. As a result of the experiment, sugar and gelatin had the greatest effect on water activity of plum jelly, and plum concentrate had the greatest effect on color. All items except for chewiness and elasticity showed differences depending on the material, and gelatin had the greatest effect. Hardness, cohesiveness, and compactness increased as the amount of gelatin increased, while viscosity decreased as the amount of gelatin increased. The sensory characteristics, firmness and elasticity, were affected by gelatin, and sweetness, amount of sugar, color, and flavor were affected by plum concentrate. As a result of synthesizing the contours of the sensory test values, the optimal range of manufacturing conditions for mesyl jelly was 12.9g for plum concentrate, 126.7-132.9g for sugar, and 13.95-14.35g for gelatin. That is, through this study, it can be seen that the plum content affects the flavor more than the physical properties of the jelly, and people prefer a low gelatin concentration.

2.1.4. Confectionery and baking

The reason for adding flavoring or coloring in the biscuit industry is to give off the flavor of the added flavor, to change or enhance the original flavor of the product, or to remove off-flavor. Coloring and flavoring methods include a method of imparting flavor to the surface of crackers, a method of releasing volatile aroma components after baking, and the like. Flavoring agents and coloring agents that can be used at the time of writing this paper include essences, fruit juice concentrates, fruit paste, essential oils, ground spices, dispersed spices, and multi-capsule flavors. In products such as biscuit peeling cream where water cannot be used, pigment powders are sometimes used to compensate for the possibility of pigment spots due to incomplete dissolution (Kim, 1978).

Confectionery and bakery terms were studied. When making products, various confectionery and bread terms are used, but the terms transmitted from France, Germany, and Japan are often mixed with Korean words and become words of unknown nationality, which is inconvenient. In order to solve these problems, this study was conducted to unify the terms by studying the correct pronunciation, notation, and meaning of the term confectionery and baking. Gateau, also known as cake in England and gâteau in France, is an exaggerated French term for a biscuit, meringue, gouache, sable, or dough, usually made with cream, fruit, chocolate, or nuts. Sweet Dough bread, called Sweet Dough bread in the UK, has a higher content of sugar, oil, and eggs than bread. The name changes depending on the shape, filling, and topping material. Red bean bread, streusel bread, and cream bread belong to this category. Mousse, called Mousse in the UK and France and Schaum in Germany, refers to light quanta in a foam state, and refers to a snack made by adding foamy whipped cream or white to a soft puree state. Mousse is a French word meaning 'foam' and has a lighter texture than bavaois. Sable is called shortbread in England and Sable in France, and is a confectionery made by mixing enough butter. Sable means sugar in French, and it is characterized by sprinkling sugar on the surface and baking it to a crisp. Sables are called cookies in the US and biscuits in the UK. Dough is a Japanese character for dough, and in Japanese it is read as 'giji' (Korea Bakers Association, 1997).

A study was conducted on the effect of raw materials on cookie dough and product properties. As the amount of added sugar increased, the dough properties decreased and the tackiness seemed to increase. As a result of measuring cookies, the spreadability and texture increased, the moisture content decreased, and the surface color became darker. As the sugar particles

increased in the form of powder, the dough properties increased and the adhesiveness decreased. As a result of measuring cookies, the spreadability decreased, the moisture content and texture increased, and the surface color became brighter. In addition, as the amount of shortening increased, the hardness and adhesion of the dough decreased, and as a result of measuring cookies, the spreadability increased. It can be seen that the water content decreased and the surface color became darker. The texture showed a significant decrease in hardness when 45% was added and the highest brittleness when 30% was added. As the amount of rice flour added instead of wheat flour increased, the dough properties decreased and the adhesiveness increased when 100% rice flour was substituted. As a result of measuring cookies, it can be seen that the hardness decreased among spreadability and texture, but the moisture content and brittleness (texture) increased, and the surface color became brighter when rice flour was added. As the amount of added xylitol, which replaced sugar, increased, the dough properties decreased significantly and the adhesiveness increased. As a result of measuring cookies, it can be seen that the moisture content increased, and when 60% of xylitol was added, the spreadability decreased, the brightness of the surface was decreased, and the texture was greatly reduced (Han, 2004). A study was conducted on the manufacture and quality evaluation of potato biscuits using mealworms and pollack mixtures, and potato biscuits were made with 0%, 10%, 20%, 30%, 40% (mealworm) and 0%, 40%, 20%, 10 (pollack), respectively, to develop high-protein children's snacks using wheatworms and pollock mixtures. As a result of measuring the chromaticity, the brightness and yellowness decreased significantly as the level of mealworm powder added increased, but the redness increased significantly as the level of added mealworm powder increased. As a result of measuring mechanical properties, it can be seen that the hardness, gumminess, and chewiness increased significantly as the ratio of mealworm powder added increased, but there was no significant difference in cohesiveness and elasticity. As a result of sensory evaluation, in terms of color, taste, texture, and overall acceptance, the potato biscuit with 20% mealworm powder had the highest score. As a result of analyzing the general components of potato biscuits with 20% wheat worm powder added, it can be seen that compared to the control group, the moisture and carbohydrate contents were lower, but the crude flour, crude fat, and crude protein contents were high. In addition, the amino acid composition was also superior to that of the control group. In other words, through this study, it can be seen that there is a possibility of making potato biscuits using a mixture of wheatworms and pollock and using them as snacks for growing children (Lee, 2018).

In Korea, recently, confectionery and bakery departments have been newly established at several universities in Gangwon-do, and the status of the bakery is rising through the diverse backgrounds of students. In Yeong-dong, Gangwon-do, high schools are also conducting confectionery-related education programs, and bakery technician tests are also starting in Gangwon-do, and the passing rate of this test is high, so it cannot be simply considered a concern for young age groups (Oh, 2001).

The function and role of confectionery and baking ingredients were studied. All ingredients except salt among baking materials are considered to deteriorate in quality if preserved for a long time, so it is important to keep the remaining ingredients correctly to maintain freshness. There are various paths for the deterioration of baking materials, such as contamination by mold and various bacteria, excessive exposure to moisture, when combined with oxygen in the air, exposure to ultraviolet rays in direct sunlight, and contamination by insects. Looking at the function of each ingredient and proper storage method, flour is divided into strong flour and soft flour according to the protein content. Flour with a high protein content is a strong flour and is mainly used for making bread such as bread, and wheat flour with a low protein content is used for making confectionery such as sweets. Among the proteins contained in wheat, glutenin has firmness and gliadin has viscoelastic properties. When water and physical force are added to these two protein components, elastic protein is formed, which is called gluten. Gluten is an important property that allows bread dough to rise. It is a characteristic unique to wheat that cannot be found in rice, barley, or corn. Such flour should be stored in a cool, dry place, that is, at a temperature of 20°C and a humidity of 65%. When stored at a high temperature, the flour begins to decay by microorganisms, and when stored for a long period of time, it is oxidized by oxygen in the air and the elasticity, which is a property of gluten, is reduced. Water is an essential ingredient in confectionery and baking, and it is divided into free water and bound water according to the type of bonding. In addition, it can be divided into distilled water, soft water, hard water, and hard water according to the mineral content dissolved in water. In confectionery and baking, hard water is considered the best water. Salt has an important function of giving flavor to bread and highlighting the flavor of other ingredients. Salt prevents the propagation of various bacteria, prevents abnormal fermentation during long-term fermentation, and has an excellent effect in removing unpleasant odors. Since salt generates osmotic pressure that takes moisture away from the plasma membrane of yeast, if you add a lot of salt or mix it with yeast, it inhibits the activity of yeast, making fermentation difficult. Yeast is easily soluble in water and disperses well in the dough, so fresh, uncontaminated yeast should be used. Yeast generates heat and organic acids such as carbon dioxide and alcohol during fermentation. Be careful not to expose raw yeast to high temperatures for a long time, and it is recommended to use the yeast vacuum-packed with aluminum within one year. Oil is a compound word of 'oil', which is liquid at room temperature, and 'fat,' which is solid. In pastry and baking, shortening, margarine, butter, etc. are mainly used

for fats and oils. At the end of the 19th century, shortening was made by mixing cottonseed oil with beef oil, but in the early 20th century, hydrogenated oil manufacturing technology developed and began to make fat of the desired consistency from plant and animal oils. Margarine is a product made as a substitute for butter, and butter can be divided into fermented butter widely used in Europe, non-fermented butter widely used in Korea, salted butter with salt and unsalted butter without salt. Oil and fat form a thin film on the gluten layer of the dough to suppress gas permeation, so it has the characteristic of increasing the expansion by improving gas retention. Powdered milk in confectionery and bread is mainly used a lot of skim milk powder. In addition, the nutritional aspect of milk powder is important as it supplies lysine, an essential amino acid to bread, to make up for what is lacking in vegetable protein. Powdered milk has the characteristic of absorbing moisture and odors in a humid place, so it is recommended to store it in a cool place below 20°C. Lastly, the yeast hood is used for fermentation control and quality improvement (Lee, 1995). The various roles of sugar in confectionery and baking are summarized. First, it has good water retention and absorbs moisture to prevent the cookie dough from drying out to keep the product moist, and it also improves the quality by preventing the dehydration of jelly or jam. By adding sugar to the egg white, the moisture separated from the protein is not recombined with the sugar, so a strong meringue can be made, the jam is thickened, and the baked cookie is prevented from being oxidized. This is because sugar binds with the moisture in the oil and makes it difficult for oxygen to permeate into the moisture. In addition, when making pudding, the moisture contained in the protein of the egg absorbs the sugar, which increases the coagulation temperature of the egg, which makes it difficult to coagulate the protein, so it becomes a soft pudding. Second, sugar is also closely related to the color change by heating, which is because two kinds of components, amino group of amino acid and carbonyl group of reducing sugar, change by heating and cause browning. Third, sugar also acts as a dehydrating agent, and if you sprinkle sugar on the fruit, the water will come out of the fruit. Fourth, it helps the fermentation of bread. When yeast breaks down sugar in bread dough to produce alcohol and carbon dioxide, this energy is used to ferment bread (Kim, 2003).

2.2. Characteristics of scones

The first commercially sold cookie in the United States in 1830 in an iron box is an American name, and is called a biscuit in England, sabre in France, and dried confectionery in Korea. In general, cookies are mixed with sugar in butter or shortening, and then eggs are mixed to make dough by mixing baking powder, spices, and flour, which is mainly an American method, and nuts or ginger powder such as peanuts is added in the British way (Jung, 2020). A scone is one of Britain's representative cookies, a biscuit that goes well with black tea. This scone is a dessert that first appeared in Scotland, England, and it is an authentic snack that is popularly loved by British people as it is always on the menu without missing tea time. Scones are made with flour, butter, milk, sugar, baking powder, and eggs as main ingredients. They are crispy on the outside and soft on the inside. In England, scones are usually eaten with cream, jam, butter, or lemon. Usually, when making scones, it is good to add hard butter because the texture of the butter decreases, and if you add eggs or milk and mix it too hard and when the finished product is baked for a long time, it is good to mix it lightly after adding eggs and milk. For those who like chewy texture, adding nuts or dried fruits to the scones can give the scones a touch of chewiness. Also, there are two ways to make the shape of the scones: one is to roll the dough and then print it out with a cookie mold, and the other is to shape it by hand. The latter is mainly used (Park, 2006).

2.2.1. Prior research on scones

Butter, shortening, and margarine, which are maintaining ingredients for scones, are causing cardiovascular disease and hypercholesterolemia, and baking methods have recently emerged to replace them with vegetable oil, soy milk, whipped cream, yogurt, and cheese. In addition, as health-oriented consumers increase in modern society, interest in alternative flours such as functional rice flour and black rice flour instead of wheat flour and functional ingredients such as aronia and lentils is increasing. We studied the effects of four types of oils: butter, whipped cream, olive oil, and coconut oil on scones, which are preferred in scones using butter, olive oil, and coconut oil compared to whipped cream, indicating that olive oil or coconut oil would be good as oils to replace butter (Choi, & Jung, 2019). A study was conducted on the quality characteristics of Beksulgi with added pomegranate concentrate. In this study, Baekseolgi was prepared by adding different amounts of pomegranate concentrate to 0, 1.6, 3.3, 5, and 6.6%. Looking at the result of the moisture content, it was 29.28% and the moisture content of the control was 31.90%. That is, the moisture content of Baekseolgi made by adding pomegranate concentrate decreased significantly as the amount of supplementary material increased. In addition, according to the consumer preference test, the color preference was significantly higher, the flavor preference was 5% added Baekseolgi, the taste preference was 1.6%, and the two Baekseolgi were significantly different from the control. That is, the overall acceptability decreased as the pomegranate concentrate content increased (Choi, & Lee, 2015).

3. Materials and Methods

3.1. Materials for experiments.

The plum concentrate was used at home in 2014. Mineral flour (CJ white rice), butter (no salt, CALIFORNIA DAIRIES INC), eggs (CJ), milk (Seoul Milk), sugar (white sugar, CJ CheilJedang), salt (CJ CheilJedang), vanilla extract (bread garden), and baking powder (country food) were purchased and used on the market.

3.2. Experimental method

3.2.1. Plum concentrate preparation

After washing 1 kg of plum in water, the water was removed. 1kg of dried plums and 1kg of sugar were alternately stacked in a barrel. In the meantime, the sugar that has settled at the bottom of the barrel was stirred well with a spoon. After 100 days, the fruits were removed and only the extract was used.

3.2.2. Preparation and characteristics of scones added with plum concentrate

One egg yolk, 2g of vanilla extract, and 50-43g of milk were put in a container and mixed, and then kept refrigerated while making the dough. 280g of flour, 50g of sugar, 2g of salt, and 6g of baking powder were sifted, 110g of butter was added, mixed, and stored in the freezer for 10 minutes. A liquid material was added to the cold dough and mixed. At this time, 0-7 g of plum concentrate was added. The dough was made by dividing the dough into 70g increments and baked in an oven preheated to 170°C for 35 minutes, cooled at room temperature for 10 minutes, and then used for the experiment.

Table 1: Composition of scone added with concentrated plum

	composition(g)			
	0g	3g	5g	7g
Soft flour	280	280	280	280
Egg	60	60	60	60
Milk	50	47	45	43
Vanilla extract	2	2	2	2
Plum extract	0	3	5	7
Baking powder	6	6	6	6
Sugar	50	50	50	50
Salt	2	2	2	2
Butter	110	110	110	110

3.2.3. Sensory test of scones

The sensory test was conducted using scones cooled at room temperature for 10 minutes, and the cooled scones were cut into uniform sizes and used as samples. The questionnaire used a 7-point scale as a rating method, and the strongest score was given 7 points, and the lowest intensity score was 1 point. 1 point was very weak, 2 point was weak, 3 point was slightly weak, 4 point was normal, 5 point was slightly strong, 6 point was strong, and 7 point was very strong. Color, flavor, buttery, sweetness, moisture, and overall preference were evaluated. In the sensory evaluation, 78 university students majoring in food-related subjects participated.

3.3. Statistical analysis

For the results, one way ANOVA was performed using SPSS (Statistic package for the social science) to analyze the significant difference between the control group and the experimental group. After the one-way ANOVA, the post-hoc analysis verified that the significance between the mean values of each measurement was $p < 0.05$ by Duncan's multiple range test.

4. Results and Discussion

4.1. Quality characteristics of scones containing plum concentrate

4.1.1. Sensory test of scones

Table 2 shows the sensory evaluation results of scones containing plum concentrate. The color was 3.23 in the control group, 4.54 when 3g of plum concentrate was added, 4.77 when 5g of plum concentrate was added, and 4.23 when 7g of plum concentrate was added, and the highest sensory characteristic value was obtained when 5g was added. There was a significant difference in that the average value tended to increase as the concentration of the plum concentrate increased. In the case of flavor, the control port was 3.08, when 3g of plum concentrate was added, 3.08, when 5g of plum concentrate was added, 3.62, when 7g of plum concentrate was added, and when 5g of plum concentrate was added, the highest functional characteristic value was shown, but there was no significant difference. The evaluation of the savory taste was found to be 3.62, 4.69 when 3g of plum concentrate was added, 4.23 when 5g of plum concentrate was added, and 4.23 when 7g of plum concentrate was added, and the experimental sphere with 3g of plum concentrate obtained the highest functional value, but little difference between the experimental zones. In the case of sweetness, the control port was 2.31, the addition of 3g of plum concentrate was 3.08, the addition of 5g of plum concentrate was 3.00, and the addition of 7g of plum concentrate was 2.46, and the largest functional characteristic value was shown, but no significant difference was shown between the experimental balls. In the case of moisture, the control port was 2.23, the plum concentrate was 2.00 when 3g of the plum concentrate was added, 2.31, and the plum concentrate was 2.23 when 5g of the plum concentrate was added, and the lowest functional value was shown when 3g was added, but no significant difference was shown. In the case of overall preference, the control port was 4.15 and 4.31 when 3g of plum concentrate was added, 3.54 when 5g of plum concentrate was added, and 3.15 when 7g of plum concentrate was added, and there was no significant difference in sensual evaluation. From the results, in the case of color, the color was the highest in the experimental sphere with 5 g of plum concentrate added, but it was possible to guess that the color reaction of the amount of sugar would be relatively small due to the amount of plum extract added. Compared to the control group, the experimental group in which 3 g of plum concentrate was added showed the highest overall preference and sweetness, which is likely due to the acidity of plum. The experimental sphere in which 3g of plum concentrate was added at a savory taste generally shows a high functional characteristic value, and the functional characteristic value sequentially decreases as the concentration of plum concentrate increases, indicating that the sour flavor of plum offset the savory taste. Considering that the item of flavor or moisture did not show a significant difference compared to the control, it is considered that it is good to continuously conduct an experiment on a laboratory to which 3g or 5g of plum concentrate is added, and it is considered to show the possibility of use in the production of scone to which plum concentrate is added.

Table 2: Sensory evaluation of scone with concentrate plum

Category	0g	3g	5g	7g	F-value
Color	3.23±1.17 ^a	4.54±1.05 ^b	4.77±0.83 ^b	4.23±1.30 ^b	4.931**
Flavor	3.08±1.32 ^a	3.08±1.38 ^a	3.62±1.56 ^a	3.38±1.81 ^a	0.382
Buttery	3.62±1.04 ^a	4.69±1.55 ^a	4.23±1.30 ^a	4.23±1.74 ^a	1.238
Sweetness	2.31±0.63 ^a	3.08±1.26 ^a	3.00±1.29 ^a	2.46±1.33 ^a	1.417
Moistness	2.23±1.24 ^a	2.00±1.00 ^a	2.31±1.38 ^a	2.23±1.17 ^a	0.160
Preference	4.15±1.41 ^a	4.31±1.55 ^a	3.54±1.33 ^a	3.15±1.28 ^a	1.934

5. Conclusion

As a result of sensory test analysis, no significant difference was found between groups in the remaining categories except for color. In one-way ANOVA, the null hypothesis is that all four groups will have the same mean, and the alternative hypothesis is that at least two of the four groups will have different means. However, except for color, since the significance level was not met, the alternative hypothesis was rejected. On the other hand, in the case of color, it showed a large increase when the plum was added, and the value increased slightly as the content was increased.

In most items, such as color, savory, sweetness, and overall preference, the sensual evaluation of scones with plum

concentrate was more favorable than the control. Through this study, the experimental tool with 3g of plum concentrate was found to be superior in both nutrition and preference than the control tool with 0g of plum concentrate, so the product should be developed for the purpose of the study.

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