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# Physical Chemical and Sensory Properties of Low Sugar Gummy

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## Abstract

This research was aimed to evaluated effected of sucralose on physical chemical and sensory properties of low sugar gummy. The optimal formula of gummy consisted of water 200 ml sugar 200 g citric acid 4 g and gelatin 40 g. Sucralose were replaced at 25, 50, 75 and 100% of sugar. All of ingredient were boiled and stir until gentle then pour in to mold until cool. Chemical, physical and sensory (by 9-point hedonic scale test) qualities of the samples were determined. The best sensory test scores at 25 and 50% of sucralose. The color value (L, a*, b*) showed highest at 75% of sucralose (35.78, 3.38 and 10.08). In high sugar sample (25% sucralose) was lowest moisture content and water activity (19.10% and 0.79). The highest Gumminess Chewiness (0.71 and 6.55-6.59 kgf) were found in 75 and 100% of sucralose respectively.

**Keywords:** Gummy, Sucralose and Low Sugar Product

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## 1. Introduction

Gummy jelly is a kind of confectionery products in a group of candy gel whose main ingredient is sugar. Traditional gummy is a product of fruit or herb juice mixed with sweeteners and substances causing gel to make product with a dry-sticky texture and are tough to chew. Gummy jelly or dry jelly is dessert products derived from the gel substances such as gelatin mixed with sweeteners including sugar and glucose syrup [1]. Gummies are available in a wide variety of shapes including bears, bottles, worms, frogs, hamburgers, sharks, toy soldiers, full-size rats, large human body parts (such as hearts and feet. This product very popular in children there are consume in high amount per year. Recently,many consumers prefer low energy product and avoid taking high caloric food containing sucrose [2]. It may due to tooth decay obesity and low nutritive value. The obesity epidemic is a global public health concern; in the US obesity has been associated with leading causes of preventable deaths, such as cardiovascular disease, stroke, and diabetes. Researcher has developed low sugar confectionary product. Sweetener were use as sugar replacer such as sucralose aspartame and sugar alcohol [3]. Sucralose is an artificial sweetener and sugar substitute. Sucralose, the only noncalorie sweetener created from sugar is approximately. Sucralose with its sugarlike taste [4]. The majority of ingested sucralose is not broken down by the body, so it is noncaloric. Sucralose is 600 times sweeter than sucrose. It is stable under heat and over a broad range of pH condition. Sucralose has been accepted as safe (FDA) the amount of sucralose that can be consumed over a person's lifetime without any adverse effects is 9 mg per kg of body weight per day. Sucarlose is marketed for broad use in food and beverages in over 30 countries worldwide [5]. It has stability in acidic product [6]. Gelatin is a pure protein food ingredient prepared by the thermal denaturation of collagen  It appears colorless or slightly yellow and commercially solid as transparent, brittle, odorless and tasteless granule, sheets, flakes or powder, soluble in hot water, glycerol and acetic acid, and insoluble in organic solvents. Gelatin is regarded as a food ingredient rather than an additive and it is "Generally Regarded as Safe" (GRAS). In 1993 the FDA announced again that there was no problem to the use of gelatin from animal sources. Gelatin is also used as a gelling agent forming transparent elastic thermo-reversible gels on cooling below about 35°C [7]. This research was aimed to evaluated affected of sucralose on physio-chemical and sensory properties of low sugar gummy.

## 2. Materials and Experiment

### 2.1 Augmented Reality Technology for Food Safety

All ingredient purchase from supermarket. Sucralose purchase from scientific equipment shop. Low sugar gummy prepared by water 200 ml sugar 200 g citric acid 4 g and gelatin 40 g. The ratio of sugar and sucralose were varied at (75:25, 50:50, 25:75 and

0:100). Premix gelatin with sugar. Then put all of ingredient were boiled in saucepan. Stir until all ingredient dissolved waiting until boiled adjust total soluble solid to 70o Brix then pour in to the mold. Kept in refrigerator for 4 hours. All of samples were analyzed for color (L* a* and b* values) by a chromameter (Minolta Co., Ltd, Osaka, Japan), water activity by Aqualab water activity meter (model series 3, Decagon Device Inc., Pullman, USA.). AOAC methods were used for determination of moisture content [8]. The texture profile analysis required to duplicate press the gummy was determined by a texture analyzer (TA-XT2 Plus, Stablemicrosystems Co. Ltd., Surrey, UK) using a cylinder probe. Sensory evaluation was conducted by a 5-point hedonic scale test using 50 panelists.

### 2.2 Statistical Analysis

The experimental data was subjected to analysis of variance and mean comparison by Duncan's multiple range tests, in order to determine any significance of the differences in the data.

## 3. Results and Discussion

The sensory evaluation revealed that taste panelists liked (overall acceptability score of 4.00) gummy from 50:50 sugar: sucralose ratio more than other samples. The panelists disliked the ratio 0:100 sample (overall acceptability score of 2.25). This may due to sucralose has a sweet test Acceptability scores for all attributes (color, flavor, sweetness and texture) for 25:75 and 50:50 samples were not significantly different ($p>0.05$). The highest acceptability scores were given to color attributes, whereas the lowest scores were given to flavor attributes for both samples (Table 1).

Qualities of the low sugar gummy samples are shown in Table 2. The sample at 25:75 and 0:100 were the brightest sample due to samples were low sugar content to produce caramelization give a brighter color. The sample ration 75:25 had darkest color. This due to high sugar content to produce maillard reaction [2, 9]. Sucralose inhibited recrystallization of sucrose affect to light scattering [10]. A positive a* values of all sample. A positive a* value signifies redness of the sample, whereas a negative value represents green color. The sample ratio 0:100 had lowest a* values, indicating that the sample were bit red than another sample. It may cause sugar expose to high temperature to maillard reaction [2]. There was significant difference between the b*. The highest b* values, indicating that the sample were bit yellow than another sample. The moisture contents of the samples from different sugar: sucralose ratio was significantly different ($p < 0.05$). The sample 75:25 ratio gave the lowest basis moisture content (19.10%), whereas the sample 0:100 gave the highest value of 51.81%. This may due to low total soluble solid. Water activity of the samples corresponded to the moisture content. The dried samples had aw in the range of 0.79-0.88. The sample 75:25 ratio had the lowest aw due to its lower moisture content. The highest aw was found in the 0:100 sample.

The texture profile analysis was shown on Table 3. The hardness was not significant. It may due to sucralose not affect to hardness. Mepanya

(2008) had reported hardness depend on gelatin concentration. For all texture data (Cohesiveness, Springiness, Gumminess, Chewiness) was highest at 25:75 and 0:100 ratio. This may due to low sugar crystal structure in gummy [11] and sucralose had a small structure can disperse in to gel structure result to gel strength [12]. Adhesive Force was highest at 75:25 ratio sample this may due to sugar. Sugar is a humectant can absorb moisture into sample this cause to sticky of product.

**Table 1** Sensory Test Scores of Low Sugar Gummy

| Property | Sugar: sucralose ratio | | | |
|---|---|---|---|---|
| | **25:75** | **50:50** | **25:75** | **0:100** |
| color | $4.15^{a}$ ± 0.58 | $4.20^{a}$ ± 0.69 | $3.60^{c}$ ± 0.88 | $3.65^{b}$ ± 1.04 |
| flavor | $3.50^{a}$ ± 0.88 | $3.25^{a}$ ± 0.85 | $3.20^{a}$ ± 0.89 | $3.00^{a}$ ± 1.29 |
| sweetness | $3.65^{a}$ ± 1.04 | $3.60^{a}$ ± 1.42 | $3.90^{a}$ ± 1.96 | $2.55^{b}$ ± 1.14 |
| texture | $3.70^{a}$ ± 1.12 | $4.00^{a}$ ± 1.12 | $3.60^{a}$ ± 1.09 | $2.40^{b}$ ± 1.04 |
| Overall acceptability | $3.95^{a}$ ± 0.88 | $4.10^{a}$ ± 1.02 | $3.40^{b}$ ± 1.04 | $2.25^{c}$ ± 1.11 |

**Table 2** Physical and Chemical Quality of Low Sugar Gummy

| Property | Sugar: sucralose ratio | | | |
|---|---|---|---|---|
| | **25:75** | **50:50** | **25:75** | **0:100** |
| color | $28.16^{c}$ ± 1.79 | $31.74^{b}$ ± 3.50 | $35.78^{a}$ ± 0.63 | $34.36^{ab}$ ± 1.02 |
| flavor | $2.98^{a}$ ± 0.94 | $2.84^{a}$ ± 0.92 | $3.38^{a}$ ± 0.37 | $1.16^{b}$ ± 0.76 |
| sweetness | $4.28^{c}$ ± 0.67 | $8.30^{ab}$ ± 3.08 | $10.08^{a}$ ± 0.34 | $7.54^{b}$ ± 0.47 |
| texture | $19.10^{d}$ ± 0.21 | $35.32^{c}$ ± 0.26 | $42.93^{b}$ ± 0.01 | $51.81^{a}$ ± 0.19 |
| Overall acceptability | $0.79^{b}$ ± 0.03 | $0.85^{a}$ ± 0.01 | $0.87^{a}$ ± 0.01 | $0.88^{a}$ ± 0.02 |

**Table 3** Texture Analyzer of Low Sugar Gummy

| Property | Sugar: sucralose ratio | | | |
|---|---|---|---|---|
| | **25:75** | **50:50** | **25:75** | **0:100** |
| Hardness$^{ns}$ (kgf) | 1.19 ± 0.06 | 1.34 ± 0.06 | 1.25 ± 0.29 | 1.40 ± 0.11 |
| Cohesiveness | $0.36^{b}$ ± 0.05 | $0.34^{b}$ ± 0.07 | $0.57^{a}$ ± 0.05 | $0.51^{a}$ ± 0.02 |
| Springiness (mm) | $8.99^{ab}$ ± 0.07 | $8.78^{b}$ ± 0.42 | $9.30^{a}$ ± 0.08 | $9.24^{a}$ ± 0.07 |
| Gumminess (kgf) | $0.43^{b}$ ± 0.05 | $0.45^{b}$ ± 0.12 | $0.71^{a}$ ± 0.17 | $0.71^{a}$ ± 0.03 |
| Chewiness (kgf.mm) | $3.87^{b}$ ± 0.46 | $4.03^{b}$ ± 1.21 | $6.59^{a}$ ± 1.61 | $6.55^{a}$ ± 0.35 |
| Adhesive Force (kgf) | $0.05^{a}$ ± 0.01 | $0.05^{a}$ ± 0.02 | $0.02^{b}$ ± 0.00 | $004^{a}$ ± 0.01 |

## 4. Conclusion

The high sucralose content sample was low overall acceptability but lighter than high sugar content sample. The redness and yellowness depend on maillard reaction. Moisture content and water activity was affected by sugar content. All of sample was affected to texture profile analysis data. This cause from gelatin form gel.

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