

Development of Blueberry Cakes with Addition of Mealworm Powder (*Tenebrio molitor* Lavare) Using sensory evaluation

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Abstract

*In the search for another appealing source of future food to cover the increasing need for nutrients of a growing global population, this study reviewed the potential of insects as human food. This study assessed some common edible insects, but concentrated on mealworms. Insects, especially mealworms, have a similar or higher nutritional value than many conventional food sources. The present study aimed to promote health through the development of blueberry cake by Mealworm Powder (*Tenebrio molitor* Lavare).*

The results of Sensory evaluation comparison of Blueberry cake to different levels of mealworm powder. The sensory evaluation showed that sample 3 had the highest color, taste, texture, and overall texture except flavour. Therefore, mealworm blueberry cake made with 60g of mealworm powder showed the best results. The results of analyzing the general components of the Mealworm blueberry cake showed more than two times higher Crude protein and less than half Crude fat compared to control blueberry cake. It is believed that the addition of mealworm powder means that the protein in the cake, a high carbohydrate food, has been strengthened. This is the development of bakery products with both nutritional excellence and symbolism, and it is believed that wheat worm powder is a good food material as a favorite food, not a hateful food, which will improve consumer awareness of edible insects.

Key words: Mealworm powder (*Tenebrio molitor* Lavare), Blueberry cake, development. Sensory evaluation.

1. INTRODUCTION

Bakery products are consumed in large quantities on a daily base and have an important role in human nutrition. The addition of functional ingredients to bakery products has risen in popularity due to the ability to reduce risk of chronic diseases beyond basic nutritional functions[1] Food due to the improvement of the domestic economic level and the development of the food industry. The pattern of consumption has changed greatly, and the westernization of diet, convenience. It was developed in the direction of diversification.[2]. As people's dietary patterns shift to Westernization, the pattern of stocks changes, and the number of people trying to solve their meals increases, and various confectionery and bakery products are becoming popular, and the demand for them

is also increasing [3]. Cake is one of the most popular food items to be eaten all over the world. Cake is available in various sizes, shapes, and categories. The ingredients such as flour, sugar, eggs, oil, leavening agents and conditions employed for cake preparation during [4] Cake is very popular sweet leavened baked products consumed. Widely as breakfast or evening snack foods. These are highly appreciated by consumers due to good taste and spongy text [5]. As the link between food and health increases, the development of health functional foods is increasing day by day. In addition, the appearance of functional bakery products is not only nutritious, but also the taste, texture, and appearance of bread are developing to suit consumers' tastes [6] Traditionally, Cake recipe is mainly composed of wheat flour, sugar, vegetal oil, egg and milk. For this reason, persons with cardiovascular disease are unable to consume this type of baked product since they are made with wheat flour [7] The life cycle of modern people gets shortened and purchase behavior is also changing with diverse pattern. Recently, customers' interest in healthy, nutritious, and functional food is increasing with the well-being trend. One of main concerns of modern people is health. Healthy life is considered as the most important issue in life. In the diet, decreases in activity, and increases in consumption of animal-source foods and flour, causing nutritional imbalance [8]. Thus, bakery sector produces and sells many functional products that functional foods are added. Industrial advancement increased the demand for bakery products as well as the consumption for the convenient foodstuff, which is simple, increased. Moreover, whereas lack of nutrition was a problem in the past, today, we face excessive nutrition

Edible insects are attractive raw materials that can meet the needs to the improvement of users' health functions. Insects are very efficient in organic matter biotransformation (high feed conversion ratio) becoming a high nutritional value biomass [9]. The world population is increasing at a high rate. Higher population will generate greater demand for food and other resources, particularly animal protein [10]. Considering the rising population worldwide and the increasing demand for additional sources of proteins, insects are seen as an economical alternative [11]. For the above reasons, an alternative source of protein is needed to assist in assuring food security for the increasing global population. One such source could be insects [12]. Mealworm larvae (*Tenebrio molitor*) are edible insects consumed by people in many Asian countries, particularly in Southeast Asia.[13]. One of the novel sources that could help meet future protein demands is insects. With protein contents reported between 35 and 61% (Rumpold & Schluter, 2013) many species of insects are richer in protein than beans (23.5% protein), lentils (26.7% protein) and soybeans (41.1% protein). [14]. Edible insects emit much less greenhouse gases and ammonia than livestock during breeding, low water consumption, low space requirements of breeding facilities, and low labor intensity, so women can raise them. It also has many eco-friendly and sustainable characteristics such as high feed efficiency, fast life history, and low disposal rate compared to other livestock. [15]. Mealworm(*Tenebrio molitor* Lavare) is a representative insect food, which contains high protein content and fat, so its nutritional value is high. In Korea, legislation of insect industry law provides the funding on the research and commercialization of insect farming. Korea has a long history of entomophagy but most for the medicinal purpose not for the dietary needs. [16]. Therefore, the present study aimed to promote health through the development of Blueberry Cakes by using Mealworm (*Tenebrio molitor* Larvae) powder and to be helpful in activating the local economy by enhancing the consumption of Mealworm (*Tenebrio molitor* Larvae).

2. STUDY METHUDS

First, literature research and market research were conducted to conduct this study. Experimental cooking was carried out and sensory evaluation and proximate composition analysis were carried out. A flowchart illustrating Research model is shown in Fig. 1.

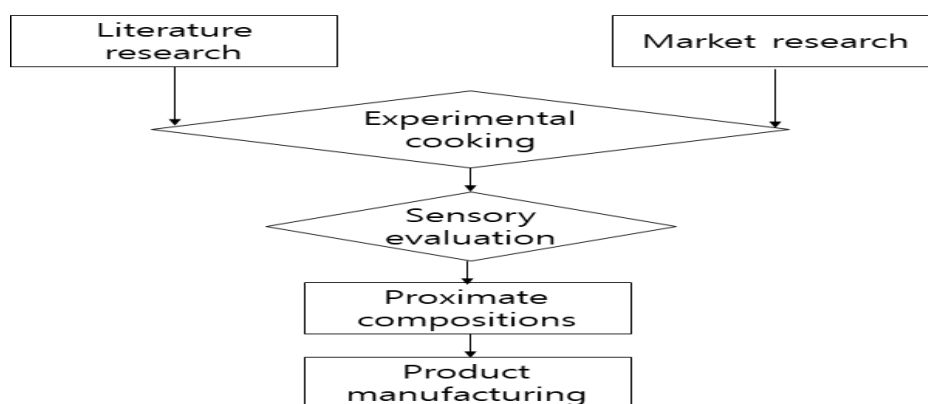


Figure 1. Flowchart of the proposed Product manufacturing

2.1 Study Subject

The Sensory evaluation of blueberry cakes were conducted on 40 students of Honam University after conducting education related to the purpose of this study and the Sensory evaluation. After cooling the freshly baked blueberry cake at room temperature for two hours, a blueberry cake for evaluation of appearance, and other sensory evaluations were performed by cutting the middle part of the specimen into a certain size (4x4x3 cm), each in a white dish and providing it at room temperature with water at the same time. The seven-point grading system was used for flavor, color, taste, texture, and overall preference, respectively, with one point being "very bad," four point being "normal," and seven being "very good." [17].


2.2 Data Processing

For data analysis, the questionnaires with answers completed were collected, data with double entry or no-entry was excluded, and valid samples were coded according to the guideline of coding. The coded data was input individually into the computer, and then frequency analysis, Duncan's multiple range test ($p < 0.05$) was used to determine the difference among the treatment mean of SPSS Windows 19.0 Version statistical program.

3. MATERIAL AND METHODS

Mealworm powder (*Tenebrio molitor* Larvae) is made Hanmi Commercial(Paju, Korea) "Mealworm Powder balance" was used, the protein content of the powder was 60.40%, carbohydrate 12.22% and fat 19.78%, and the calorie content was confirmed to be 4.69 kcal per g. Blueberry were Purchased from Ho Farm(Youngdon, Korea). Flour and sugar, grape seed oil were purchased from CJ Cheil Jedang (Seoul, Korea), and salts (Hanchu salt, Ulsan, and Korea) were also purchased and stored at room temperature. The preparation of Mealworm blueberry cakes made by AACC. The mixing ratio is as shown in Table 1. and the standard process is shown in Figure 2. Therefore, the present study aimed to promote health through the development of Blueberry cake by using Mealworm (*Tenebrio molitor* Larvae).

Table 1. Formulas of Mealworm Blueberry cake(1 potion)

<i>Ingredient</i>	<i>Ingredient</i>	<i>Food Photography</i>
Blueberry cake sheet		
Grape seed oil	500	
Honey	60	
Citron syrup	30	
Citron jest	15	
Egg whole	110	
Sugar	301	
Almond powder	120	
Mealworm powder	60	
Flour soft	100	
Baking powder	2	
Baking soda	2	
<i>Blueberry</i>	<i>100</i>	
Yorgurt cream cheese filling		
<i>Cream cheese</i>	<i>100</i>	
<i>plain yourgurt</i>	<i>10</i>	
<i>sugar powder</i>	<i>3</i>	
sugar powder	5	

Standard Recipe

1. Put the measured grape seed oil, honey, citron syrup, and citron zest in a pot, boil to 90°C, then cool to 35°C.
2. Combine the eggs and sugar simmering at 40°C and froth with a whisk until it turns white.
3. Prepare mealworm powder, almond powder, and flour by filtering them in a sieve.
4. In 2, add the mealworm powders, almond powder, salt in the amount of flour, baking powder, and baking soda and mix.
5. Cool the process of 4 to 35°C, add 1 and mix it with a spatula, and add blueberries to finish the dough.
6. Bake at 170°C oven for 25 to 30 minutes.

Yorgurt Cheese filling

1. Gently dissolve cream cheese in a mixing bowl and mix with plain yogurt.
2. Add sugar powder juice and mix them with a whisk.

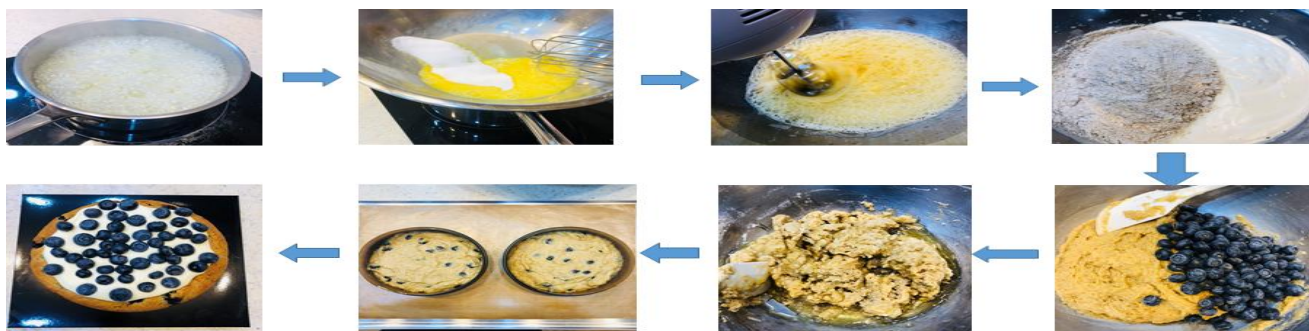


Figure 2. Flowchart of the proposed Product manufacturing

4. RESULTS

4.1 Sensory Evaluation Analysis

Table 2. Compares the sensory evaluation results of the Mealworm Yogurt Muffin to different levels of mealworm powder

Table 2. Sensory evaluation of mealworm blueberry cake with different levels of mealworm powder

	¹⁾ sample 1	sample 2	sample 3
Flavor	4.31±1.25 ^{2)a}	4.81±1.22 ^c	4.78±1.25 ^a
Color	4.70±1.14 ^b	4.62±1.12 ^d	4.62±1.12 ^d
Taste	4.62±1.12 ^d	4.11±0.43 ^b	4.11±0.43 ^b
Texture	4.18±1.03 ^a	4.78±1.23 ^a	4.87±1.56 ^a
Overall quality	4.11±1.33 ^b	4.81±1.03 ^d	4.96±1.44 ^b

1) Sample 1: muffin prepared with mealworm powder 20, Sample 2: Muffin prepared with mealworm powder 40g, Sample 3: Muffin prepared with mealworm powder 60g

2) Means±sd

3) Means with different letters in the same column are significantly different at p<.05 by Duncan's multiple range test.

The results of Sensory evaluation comparison of Blueberry cake to different levels of mealworm powder. Mealworm Blueberry cake had the highest flavor in Sample 2, with Sample 1 being 4.31 and Sample 3 being 4.78 and Sample 2 being 4.81. Mealworm Blueberry cake had the highest color in Sample 3, Sample 1, 4.70, Sample 2 4.62. Sample 3 5.03. The taste of mealworm Blueberry cakes was highest in Sample 3, 4.81, Sample 2, 4.11 Sample 1 4.23. The texture of mealworm blueberry cakes was highest in sample 3 of 4.87, with sample 1 of 4.18 and sample 2 of 4.78. The overall quality of the mealworm blueberry cake was the highest in sample 3, sample 1 is 4.11, sample 2 is 4.81 and sample 3 is 4.96. Therefore, mealworm blueberry cake made with 60g of mealworm powder showed the best results. write or print outside of the column parameters. Margins are 2cm on the sides, 3cm on the top, and 2cm on the bottom.

4.2 Proximate compositions of Mealworm blueberry cake

Table 3. shows the results of analyzing the general components of the Mealworm blueberry cake according to AOAC(1995). In case of Mealworm blueberry cake, it revealed to contain 55.25% of carbohydrate, 8.07% of crude protein, 2.01% of crude fat, 1.01%, of crude ash, 2.96% of dietary fiber, and 30.7% of moisture. MBC showed more than two times higher Crude protein and less than half Crude fat compared to control blueberry cake. It is believed that the addition of mealworm powder means that the protein in the cake, a high carbohydrate food, has been strengthened.

Table 3. Proximate compositions of Mealworm blueberry cake and control group blueberry cake

Item	MBC(%)	A cake(%)	B cake(%)
Carbohydrate	55.25	64.1	63.2
Crude protein	8.07	4.2	2.8
Crude fat	2.01	4.4	5.2
Crude ash	1.01	0.1	1.0
Dietary fiber	2.96	1.2	2.1
Moisture	30.7	26.0	25.7

1) MBC : Mealworm powder Blueberry cake

2) A, B Blueberry cake: The control group blueberry cake sold at franchise Bakery.

5. CONCLUSIONS

The purpose of this study is to manufacture blueberry cake that reflect consumers' preference by utilizing mealworm powder with high protein content. In addition, the developed product was compared of proximate compositions analysis commercial product. The sensory evaluation analysis of mealworm blueberry cake showed that the overall quality of taste and texture increases as the amount of mealworm powder increases. Mealworm powder may improve the taste of cake without compromising its unique taste.

mealworm are easy to provide protein of high nutritional value. Mealworm powder could have potential as a good source of protein and dietary fiber which is used as functional ingredient for bakery product. Developed products are healthier than other products because they are dietary fiber and crude protein, are excellent in moisture and low in crud fat.

It is no exaggeration to say that securing competitiveness through active new product development that reflects this paradigm has become a task for the ground. Therefore, It is believed that it can be used as basic data and establishment of cooking methods for various menus using Mealworm

The cake with the addition of Mealworm Powder has been commercialized to the market.

As soon as they enter the market, it is believed that if mealworm Powder's nutrition research supports them,

In addition, it is believed that through the development of various menus and quality characteristics, various food development that reflects consumers' awareness and health will be possible.

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