

Development of Chicken Breast Sausage with Addition of Mealworm (*Tenebrio molitor* Lavare) using Sensory evaluation

Youngkyun Kim*

Department of Culinary Science, Honam University, Korea
ykkim75@hanmail.net

Abstract

*The purpose of this study is to show probability of alternate food by using edible insects through the reports (Edible insects: Future prospects for food and feed security) edited by WFO (World Food Organization). We were carried out to develop the functional meat new product using Mealworm (*Tenebrio molitor* lavare) and Chicken breast. People's interest to the healthy, low-calories food is growing up, the Foodservice industry is developing and making Functional food, which helps to a sale strategy. Insects have played an important role as human food throughout history, especially in Africa, Asia and Latin America. . A rapid increase in the human population is expected in the second half of the 21 century, which will lead to lower availability of food, especially animal protein As the problem of food supply and demand has come to the fore with climate change, Food and Agriculture Organization of the United Nations (FAO) has noticed edible insects as future food resources in order to prepare against the shortage of protein source. Recently consumers, especially patients have doubts about safety of raw materials for food. To overcome these limitations, I propose an enteral nutrition formula using edible insects as a raw material.*

Keywords: *Mealworm (*Tenebrio molitor* Lavare) Chicken breast sausage*

1. Introduction

The life cycle of modern people gets shortened and purchase behavior also changing with diverse pattern. Recently, customers' interest in healthy, nutritious, and functional food is increasing with the well-being trend. Meat products have become prevalent in people's diet, and sausages, with the Korean diet getting more westernized in modern times. In particular, emerged as one of the favorite and the most consumed food products in Korea. Since the increase in income has changed a lot in meat consumption, meat products suppliers have started to make functional products.

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) [1]. Nowadays, obesity and cardiovascular diseases are changing food consumption habits; these changes have fostered the development of products with functional ingredients that meet the

market demands for maintaining a healthy body [2].

Industrial advancement increased the demand for Meat 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. 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 [3]. Accordingly, illnesses such as obesity and other illnesses that afflict the adults are emerging as a social problem. As a solution measure, consumption of functional food is expected to alleviate chronic illnesses and illnesses that afflict adults. Likewise, there are many attempts to include functional food when producing convenient preferred food with extensive sweet taste and fat substances [4]. In view of the increasing world population and consumer demand for protein, sustainable protein production with low environmental impacts will be a serious future challenge. It has been suggested that edible insects can be a source of protein, since they are efficient feed converters with high nutritional value [5].

Insects have played an important role in human food throughout history, especially in Africa, Asia and Latin America [6]. More than 2,000 species of edible insects have been cataloged around the world, including 135 in Brazil. A rapid increase in the human population is expected in the second half of the XXI century, which will lead to lower availability of food, especially animal protein encouraging insect consumption as a way to fight hunger and promote food security; insects are a source of good nutritional quality protein for humans [7]. Mealworm (*Tenebrio molitor* Larvae) is attractive raw materials that can meet the needs to the improvement of users' health functions. Generally, Mealworm (*Tenebrio molitor* Larvae) powder is useful for high protein food since they have protein 50.32%, crude fat 33.71%, and ash 3.76%. Therefore, we aimed to promote health through the development of chicken breast sausages 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) powder.

2. Material and Methods

2.1 Study subject

Total 169 people (80 male, 89 female) in Kyonggi who culinary major student and food specialist were selected. Total 169 person (80 male, 89 female) in Kyonggi-do who culinary major student and food specialist were selected. For research tools to measure awareness and preference based on questions used by Choi MK and Jung JC. [8].

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 18.0 Version statistical Program

2.3 Proximate Composition

Compositional properties of Chicken breast Sausage performed using AOAC[9], Moisture content was

determined by weight loss after 12 h of drying at 105°C in a drying oven (SW-90D, Sang Woo Scientific Co. Korea), Fat content was determined by Soxhlet method with a solvent extraction system (Soxtec® Avati 2050 Auto System, Foss tecator AB, Sweden) and protein was determined by Kjeldahl method with an automatic Kjeldahl nitrogen analyzer (Kjel-tec®2300Analyzer Unit, Foss Tector AB, Sweden), Ash determined according to AOAC Method 923.03.

2.4 Sensory Evaluation

Chicken Breast Sausage was evaluated for color of appearance, flavor, texture, juiciness, overall taste. Chicken Breast Sausage were cooked at 95±2°C for around 1 hr., air-cooled to 8-10°C, and cooked sample were cooled to room temperature at 21°C, cut into quarters and served to the panelists in random order. Sensory evaluations were performed by the panelists under fluorescent lighting (350 lux). The cooked sample were evaluated using a 7-point descriptive scale (1=extremely undesirable, 7= extremely desirable).

2.5 Material

Mealworm (*Tenebrio molitor* Larvae) was purchased from a farmers' association in Goheung-gun, Jeollanam-do, and Fresh Chicken breast and pork ham was purchased from Kyonggi (Agricultural and marine wholesale market) located in Kyonggi,

2.6 Method

Fresh boneless chicken breast, mealworm, pork trim, pork fat, peeling citron, chili pepper, garlic, leek, salt and black pepper were purchased from local processors. Mealworm was prepared by stirring appropriate amount of flour in DW for 1 hour at room temperature by heating at 95°C with continuous stirring for 30 min. The sausage batter was then stuffed into a polyvinyl- chloride casing (4.3 cm diameter). After undergoing a setting process using a hot air dryer (WFO-600SD, RIKAKIKAI CO., Tokyo, Japan) for 3 min at 40, it was heated at 85°C for 20 min in a boiling tank. <Fig .1> shows the proportion of chicken breast sausage using mealworm shows the standard cooking process

2.7 Manufacturing

Table 1 shows formulas and recipe of Mealworm chicken breast sausage

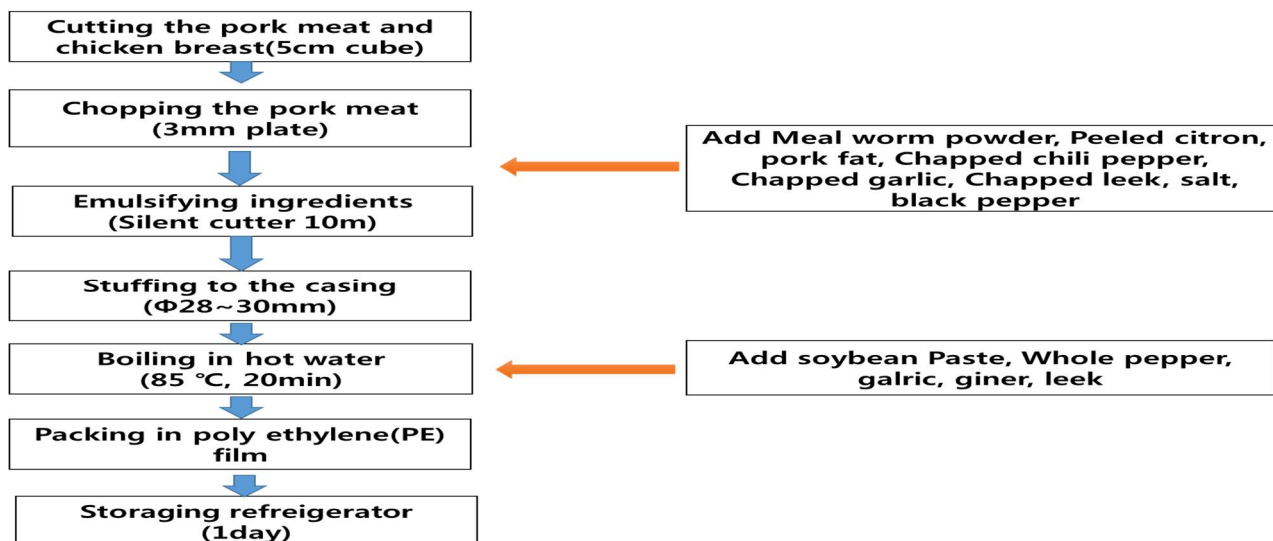


Figure 1. The manufacturing process of sausage with mealworm powder

Table 1. Formulas and recipe of Mealworm Chicken breast sausage

Mealworm Chicken breast sausage using (Serves: 10, Quantity: 1kg, Cooking time 2hr.)

• Ingredient & Quantity			
Chicken Breast	300 g	Pork Belly	200 g
Pork inside round	500 g	Chopped garlic	10 g
Casing(Pork intestine)	100 g	Nutmeg	2 0g
Citron	50 g	Majoram	30 g
Mealworm powder	50 g	Soybean paste	10 g
Salt	15 g	Chopped leek	10 g

• Standard Recipe
1. Trimming chicken breast, pork belly, pork inside round.
2. Mixed citron, mealworm powder.
3. Mixed chopped leek and garlic salt & pepper+ 2.
4. Stuffing in Casing (pork intestine) 2+3.
5. Boiled at 82°C during 20min additional soybean paste.
6. Cool off to 5 and served sauce.

Figure 2 shows the manufacturing process of Mealworm chicken breast sausage

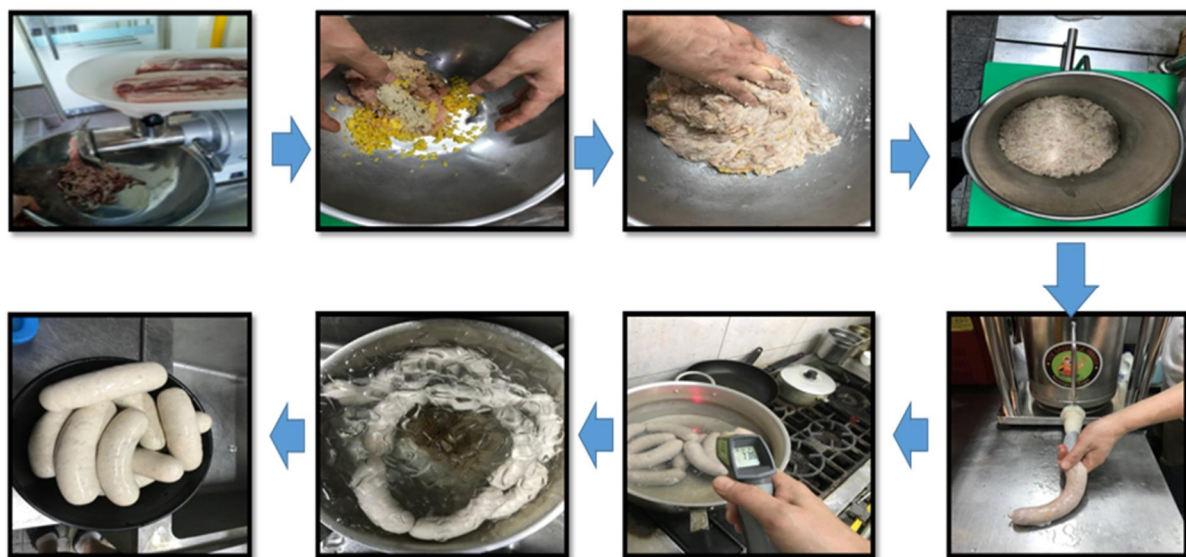


Figure 2. The manufacturing process of sausage with mealworm

3. Results and Discussion

3.1 Proximate compositions of Mealworm chicken breast sausage

Table 2 shows the results of analyzing the general components of the Mealworm Chicken breast sausage according to Korean Food standards codex (2009). In case of Mealworm Chicken breast sausage, it revealed to contain 65.83% of moisture, 1.65% of crude ash, 14.7% of crude protein, 15.4%, of crude fat, 7.8% of Calcium, and 1.8% of Iron content 1.33% of Saccharinity, 1.56 of salinity. It shows superior characteristics in terms of nutritional components than other comparative groups. Therefore, according to the change of eating habits of modern people, it seems to be beneficial to the insufficient Crude protein and Calcium, Iron content intake and it seems that it has fulfilled the functional condition as wellbeing food.

Table 2. Quality comparison of Mealworm chicken breast sausage and control group sausage

	Saccharinity (%)	Crude protein (%)	Calcium (%)	Salinity (%)	Iron content (%)	Moisture (%)	Crude fat (%)
MCS	1.33±0.1 ^A	14.7±0.1 ^A	7.8±0.1 ^A	1.56±0.01 ^C	1.80±0.01 ^E	65.83±0.3 ^A	15.4±0.7 ^D
F1	6.5±0.1 ^A	4.5±0.1 ^A	1.6±0.0 ^B	2.30±0.09 ^A	0.01±0.0 ^D	55.3±0.3 ^D	24.4±0.3 ^A
F2	5.2±0.0 ^B	3.2±0.0 ^B	2.2±0.1 ^A	2.12±0.05 ^B	0.30±0.0 ^G	56.8±0.3 ^C	24.8±0.2 ^A
F3	6.6±0.0 ^A	4.6±0.0 ^A	1.4±0.0 ^A	2.20±0.08 ^B	0.04±0.01 ^C	55.3±0.3 ^D	20.8±0.7 ^C

A, B, C, D: Means with different superscript in the same column significantly differ at $p < 0.05$

MCS: Mealworm Chicken breast Sausage

F1~F3: The control group Frankfurter Sausage sold at a large mart by 3 different companies

3.2 Sensory Evaluation Analysis comparison of Mealworm chicken breast sausage and control group sausage

Table 3 compares the sensory evaluation results of the Mealworm Chicken breast Sausage to the comparison group.

Table 3. Sensory Evaluation Analysis comparison of Mealworm chicken breast sausage and control group sausage

	Appearance	Flavor	Texture	Juiciness	Overall taste
MCS	4.41±0.55 ^D	3.91±0.53 ^A	3.99±0.45 ^C	3.95±0.24 ^A	3.98±0.38 ^A
F1	3.89±0.64 ^D	3.88±0.39 ^B	3.76±0.41 ^B	3.80±0.26 ^C	3.86±0.42 ^D
F2	3.94±0.53 ^C	3.86±0.43 ^B	3.66±0.47 ^B	3.48±0.33 ^A	3.74±0.43 ^A
F3	3.99±0.41 ^A	3.88±0.49 ^B	3.68±0.54 ^A	3.50±0.25 ^C	3.93±0.33 ^A

A, B, C, D: Means with different superscript in the same column significantly differ at $p < 0.05$

MCS: Mealworm Chicken breast Sausage

F1~F3: The control group Frankfurter Sausage sold at a large mart by 3 different companies

The results of Sensory evaluation comparison of Mealworm Chicken breast Sausage and other Frankfurt sausage produced by different company in Korean market. In case of appearance, flavor, texture, Juiciness, overall taste was higher than control Group. Mealworm Chicken breast sausage showed superior characteristics in the sensory evaluation than the other comparative groups. Appearance is 4.41 ± 0.55^D , flavor is 3.91 ± 0.53^A , and texture is 3.99 ± 0.45^C , Juiciness is 3.95 ± 0.24^A , overall taste is 3.98 ± 0.38^A .

4. Conclusion

The purpose of this study is to development of chicken breast sausage using Mealworm (*Tenebrio molitor* Larvae). In addition, the developed product was compared with the commercial product, and the sensory evaluation analysis was conducted.

The results of the study through the above research process are as follows.

First, Developed products are healthier than other products because they are crude protein and Calcium, Iron content are excellent in moisture and low in Crude fat and saccharinity. Proteins extracted from in Mealworm and used as a pure ingredient for different food applications might have greater success in terms of acceptance as a human food. Therefore, it is necessary to develop a variety of products that are good for health.

Second, in sensory analysis, Mealworm Chicken breast sausage showed high scores on appearance, flavor,

texture, Juiciness, overall taste was higher than control Group. Based on the questionnaire survey results, the development for Chicken breast Sausage using Mealworm sample products were performed along with the development for their processing techniques. In addition, with the improvement of the income level, the desire for the eating habits is becoming more and more interested in the stability of the food as well as the quality. FAO published a report [10] encouraging insect consumption as a way to fight hunger and promote food security; insects are a source of good nutritional quality protein for human. Mealworm has the value of developing various products as a food because it has high health functionalities. It was suggested that sausage formula contain meal worm and chicken breast could be used for taking up a position as new product in Sausage Market.

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