

## EFFECT OF MUSHROOM INCORPORATION ON QUALITY, SENSORY AND MICROBIAL STABILITY OF FRANKFURTER TYPE-SAUSAGE

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**Abstract** –This study was carried out to investigate the effect of *Tricholoma matsutake* mushroom addition on the quality, sensory and microbial stability of frankfurter during storage (1 and 14 d) at 4°C. Various levels (1, 2.5 and 4.5%) of ground mushroom were incorporated into frankfurters. Frankfurters with no added mushroom were used as control. Our results revealed that lightness was not affected by the mushroom addition but the redness decreased whereas the yellowness increased with increased mushroom levels. The addition of mushroom resulted in improvements of taste and flavor; sausages with higher mushroom level had higher flavor and taste scores ( $p < 0.05$ ), whereas sausages formulated with 0.01% NaNO<sub>2</sub> had the lowest flavor and taste scores. Also, the addition of mushroom reduced the number of aerobic bacteria in the sausages during storage. These results suggest that *T. matsutake* mushroom can be used as a natural functional ingredient to improve taste and flavor as well as shelf-life stability of frankfurter.

**Key Words** – frankfurter type-sausage, mushroom

### I. INTRODUCTION

The currently available chemical additives (e.g., antioxidants and antimicrobials) have been suspected to cause toxicity problems that negatively affect consumer's health (1). Therefore, a new trend to substitute these synthetic compounds with bioactive compounds from natural sources have been received the most attention by consumers and meat processors (2). In recent times, the consumed amount of mushrooms has considerably increased, involving a large number of species. Of which, *Tricholoma matsutake* is widely distributed in Asian countries and has been regarded as famous foods due to its pleasant flavor, taste and high nutritional quality such as high levels of proteins, carbohydrates, minerals and vitamins as well as low fat (3, 4). Besides, *T. matsutake* has been demonstrated to contain significant amounts of compounds such as polysaccharides with strongly bioactive properties (4). Though the *T. matsutake* has a pleasant flavor and may exert bioactive properties in sausages, which can be effectively incorporated into sausage. However, very little attention has been paid to the use of edible

mushroom as functional ingredients in meat products. Therefore, the objective of this study was to evaluate the effect of addition of *T. matsutake* on the quality, sensory and microbial stability of frankfurter type-sausage during refrigerated storage.

### II. MATERIALS AND METHODS

#### *Mushroom and frankfurter preparation*

Fresh *T. matsutake* mushroom purchased from a local supermarket (Suwon, Korea) was washed and then ground in a blender. The refrigerated pork meat and back fat were separately ground through a 3 mm plate. All sausages were prepared with same levels of following ingredients: 50% pork, 28% back-fat, 20% ice water, 0.5% phosphate and 1.5% salt. The following combinations were used; T1: 1% mushroom, T2: 2.5% mushroom, T3: 4.5% mushroom, and T4: 100ppm NaNO<sub>2</sub>. Ice water in T1, T2 and T3 was replaced by the added mushroom levels. Three batches (each 5 kg) were prepared for each treatment and the batches served as the control (C) were not added mushroom. The meat batters were prepared and then stuffed into 28-mm diameter collagen casings using a vacuum stuffer, and finally were cooked at 80 °C for 40 min in a smokehouse. The cooked sausages were cooled and then sealed in polyethylene/polyamide pouches. The quality and sensory characteristics were investigated on the day after processing (1 d) and the samples stored at 1 and 14 d at 4 °C were used to investigate microbial stability

#### *Color, microbial and sensory analysis*

Color values (CIE L\*, a\*, b\*, chroma and hue) were measured at 3 different locations on the freshly cut surface of each sausage sample using a Minolta Chroma Meter CR-400 (Osaka, Japan). Aerobic bacteria were determined on 3M Petrifilm (HealthCare, MN, USA), and each sample was repeated 3 times. Sensory traits were evaluated by trained panel 6 members using the method of Deda et al. (5).

#### *Statistic analysis*

Data were analyzed using GLM procedure of SAS program (2007).

### III. RESULTS AND DISCUSSION

Table 1 Effect of mushroom incorporation on color of frankfurter-type sausages

| item | Added level |       |       |       |               | SEM  | F. value |
|------|-------------|-------|-------|-------|---------------|------|----------|
|      | 0 %         | 1%    | 2.5%  | 4.5%  | 0.01% nitrite |      |          |
| L*   | 72.71       | 73.27 | 73.08 | 73.11 | 74.47         | 0.2  | 5.65*    |
| a*   | 2.99        | 2.83  | 2.69  | 2.42  | 4.86          | 0.06 | 12.92*   |
| b*   | 9.41        | 9.75  | 10.15 | 10.77 | 9.14          | 0.11 | 7.22*    |
| C*   | 9.88        | 10.16 | 10.50 | 11.04 | 10.36         | 0.12 | 3.72*    |
| H    | 72.36       | 73.82 | 75.16 | 77.37 | 62.01         | 0.29 | 11.90*   |

SEM: standard error of mean; C\*: chroma; H: hue; \*, p < 0.05.

Table 1 shows the L\*(lightness), a\*(redness), b\*(yellowness), C\* (chroma) and h (hue) values of frankfurters formulated with various fresh mushroom levels and 0.01% NaNO<sub>2</sub>. No differences among the treatment groups were found for the lightness (p>0.05) but the redness decreased whereas the yellowness increased with increased mushroom levels. However, sausages made with 0.01% NaNO<sub>2</sub> showed the highest a\* values and lowest b\* values. The addition of mushroom resulted in improvements of taste and flavor of frankfurter-type sausages; higher added mushroom level sausages had higher flavor and taste scores (p<0.05), whereas sausages formulated with 0.01% NaNO<sub>2</sub> had the lowest flavor and taste scores (Table 2).

Table 2 Effect of mushroom incorporation on sensory characteristics of frankfurter-type sausages

| item          | Added level |      |      |      |               | SEM  | F. value |
|---------------|-------------|------|------|------|---------------|------|----------|
|               | 0 %         | 1%   | 2.5% | 4.5% | 0.01% nitrite |      |          |
| Flavor        | 3.78        | 3.94 | 4.0  | 4.28 | 3.67          | 0.65 | 5.5*     |
| Texture       | 3.39        | 3.89 | 3.67 | 4.33 | 3.39          | 0.90 | 1.65     |
| Taste         | 3.61        | 3.72 | 3.72 | 3.94 | 3.28          | 0.92 | 8.2*     |
| Acceptability | 3.44        | 3.89 | 3.61 | 4.06 | 3.11          | 0.40 | 2.97     |

SEM: standard error of mean; \*, p < 0.05;

Rating scale: 7=extremely desirable, 1=extremely undesirable.

Furthermore, the incorporation of mushroom significantly reduced the number of aerobic bacteria in sausages during cold storage in comparison to the control however the sausages made with 0.01% NaNO<sub>2</sub> showed higher bacteria inhibition capacity (Fig. 1). The improvements of flavor and taste of sausages could be due to umami-taste active components in mushroom (3) while the

antimicrobial activity of the *T. matsutake* could be due to the presence of essential bioactive compounds as most of them exhibited antimicrobial activity.

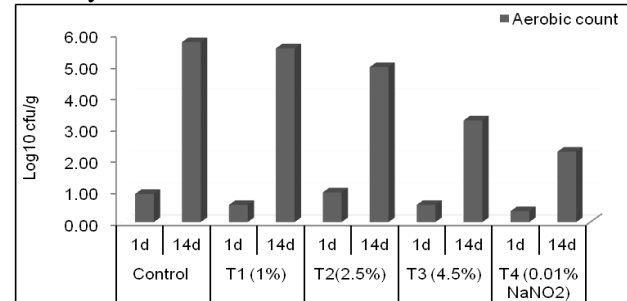


Fig. 1. Effect of mushroom incorporation on aerobic bacteria in frankfurter-type sausages during storage at 4°C.

### IV. CONCLUSION

Based on the results obtained in the present study, it is concluded that *T. matsutake* mushroom incorporation into frankfurter-type sausage formulations resulted in improvement of flavor and taste, and shelf-life stability due to reduction of aerobic bacteria growth.

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