# THE EFFECTS OF VARIOUS DIETARY FIBERS ADDITION ON THE QUALITY CHARACTERISTICS OF BLENDED PORK MEAT

J. K. Lee[1], Y. S. Choi[1], J. T. Jeong[1], J. S. Choi[2], J. Y. Jeong[3] and Y. I. Choi[1*]

[1] Department of Animal Science, Chungbuk National University, Cheongju Korea, 361-763
[2] Department of Swine Science & Technology Center, Gyeongnam National University of Science and Technology, Jinju Korea, 660-758
[3] Nature & Farmer Co., Ltd, Goesan korea, 613-11
[*]Corresponding author email: yangilchoi@chungbuk.ac.kr

**Abstract – This study was conducted to determine the effects of dietary fiber addition on the quality characteristics of pork emulsion. In the proximate analysis, the addition of dietary fibers decreased moisture values than that of NA ($p<0.05$). The addition of dietary fibers showed higher water-holding capacity values than in the NA and control, and the pH values of blended pork meats range from 5.96-6.12. In texture profile analysis, the addition of dietary fibers increased springiness, cohesiveness, chewiness, and hardness by more than NA. For the emulsion stability and cooking loss, the addition of dietary fibers significantly decreased the water and fat isolation, and cooking loss. Thus, the addition of dietary fibers had a positive effect on blended pork meat.**

**Key Words – Dietary fiber, Chicory fiber, Quality characteristics.**

## I. INTRODUCTION

In Korea, meat product production has increased steadily since 2010 (180,640 tons). Meat product production in 2015 was about 211,109 tons (Korea Meat Industries Association, 2015). This increased meat product production has had a significant impact on our food consumption patterns, causing diets to become more westernized. These diet patterns can cause diseases, such as obesity, diabetes, cardiovascular diseases, and cancer. Thus, consumers' demand for functional foods has increased and raised concerns regarding the high level of fat in processed meat products. Consequently, food and regulatory bodies have targeted issues such as fat reduction in meat products. So recently, dietary fiber has received attention in the processed meat product industry. Dietary fiber is widely known to prevent adult diseases (Wolk *et al*., 1999; Brown *et al*., 1999). The addition of dietary fibers to foods enhances nutritional value and technological properties, as well as prevents and treats some diseases (Thebaudin *et al*., 1997). Furthermore, dietary fiber in food facilitates development of quality properties such as solubility, viscosity and gelation-forming ability, water-binding or holding capacity, oil-binding capacity, and mineral and organic molecule-binding capacity (Tungland and Meyer, 2002). Therefore, this study was conducted to evaluate the addition of dietary fiber on quality characteristics of blended pork meat.

## II. MATERIALS AND METHODS

(1) Testing materials

Certified organic grade vacuum-packed, refrigerated lean pork (*longissimus* muscle) was obtained from Hansalimfood. Dietary fibers included chicory fiber (Lyntz Inc., Seoul, Korea), brown rice bran fiber (Cheolwon Agricultural Union Corporation, Cheolwon, Korea), wheat fiber (J. Rettenmaier & Sohne GMBH + Co. KG, Berlin, Germany), and indigestible maltodextrin (Edentown FnB, Seoul, Korea).

Table 1. Formulations of blended pork meats (%)

| Items* / Treat-Ments | Ground pork | NaCl | STPP | CF | WF | BF | IM |
|---|---|---|---|---|---|---|---|
| NA[1)] | 100 | - | - | - | - | - | - |
| Control | 100 | 1.50 | 0.20 | - | - | - | - |
| T1 | 100 | 1.50 | 0.20 | 1 | - | - | - |
| T2 | 100 | 1.50 | 0.20 | 3 | - | - | - |
| T3 | 100 | 1.50 | 0.20 | - | 1 | - | - |
| T4 | 100 | 1.50 | 0.20 | - | 3 | - | - |
| T5 | 100 | 1.50 | 0.20 | - | - | 1 | - |
| T6 | 100 | 1.50 | 0.20 | - | - | 3 | - |
| T7 | 100 | 1.50 | 0.20 | - | - | - | 1 |
| T8 | 100 | 1.50 | 0.20 | - | - | - | 3 |

*NaCl: Sodium chloride, STPP: Sodium tripolyphosphate, CF: Chicory fiber, WF: Wheat fiber, BF: Brown rice bran fiber, IM: Indigestible maltodextrin
[1)]NA: Non-addition.

(2) Manufacture of blended pork meat

The blended pork meat were prepared using 100% ground lean pork (Non-addition, NA). For comparative experiments, we added 0.2% of sodium tripolyphosphate (STPP) and 1.5% of sodium chloride (NaCl). The formulations of the blended pork meat containing dietary fiber are presented in Table 1. For each treatment, pork was ground (Particle size: 4.5mm) using a meat grinder (M-12S, FUJEE, Suwon, Korea), and then NaCl and STPP were added to the meat and mixed for 3 min. Dietary fiber was added and mixed for 3 min. The temperature of the blended pork meat was maintained below 10 ℃ during the mixture preparation. The blended pork meat was stored at 4 ℃ during 24h and immediately used to analysis. Analysis traits were moisture, fat, ash, water holding capacity (WHC), pH, texture properties, emulsion stability, and cooking loss.

(3) Statistical analysis

Statistical analyses were carried out using the generalized linear model procedure of the SAS package Release 9.4 (SAS Institute, Cary, NC, USA). Means were compared using Duncan's multiple range test at a level of significance of $p< 0.05$.

## III. RESULTS AND DISCUSSION

The effects of dietary fiber on proximate analysis, WHC, and pH of blended pork meat are presented in Table 2. The addition of various dietary fibers resulted in lower moisture values compared to NA ($p<0.05$). Similar results were observed for ground pork meat products made using rice bran fiber (Choi *et al*., 2008). The addition of various dietary fiber significantly increased WHC values than that of NA, and the brown rice bran fiber 3% were the highest WHC value among the treatments. According to the result of Choi *et al*. (2008), the water-holding capacity of ground pork meat increased after the addition of rice bran fiber. The pH values of blended pork meats were in the range of 5.96–6.12. In the pH values of treatments with dietary fibers, the treatments with 3% dietary fibers showed lower pH values than those of treatments with 1% dietary fibers except for treatments with wheat fiber.

The result of texture profile analysis was showed in Table 3. The addition of various dietary fibers significantly increased springiness values compared to NA, and increased cohesiveness, chewiness, and hardness values more than NA and control. In the comparison among dietary fibers, the treatment added with 3% brown rice bran fiber showed lower TPA values compared with the other treatments.

Table 2. Proximate analysis (%), WHC[1)] (%), and pH of blended pork meat following addition of dietary fibers

| Treatments* | Moisture | Fat | Ash | WHC | pH |
|---|---|---|---|---|---|
| NA[2)] | 77.09 ±0.62$^{a}$ | 2.19 ±0.05$^{bcd}$ | 1.04 ±0.01$^{f}$ | 55.56 ±3.46$^{c}$ | 6.05 ±0.02$^{bcde}$ |
| Control | 75.39 ±0.71$^{b}$ | 2.44 ±0.33$^{ab}$ | 2.53 ±0.02$^{ab}$ | 70.83 ±2.63$^{b}$ | 5.96 ±0.01$^{f}$ |
| T1 | 74.25 ±0.76$^{bcd}$ | 2.21 ±0.02$^{bcd}$ | 2.53 ±0.03$^{abc}$ | 73.17 ±3.79$^{ab}$ | 6.08 ±0.02$^{abc}$ |
| T2 | 73.32 ±0.59$^{cd}$ | 2.16 ±0.01$^{bcd}$ | 2.48 ±0.02$^{cd}$ | 73.17 ±5.55$^{ab}$ | 6.04 ±0.01$^{cde}$ |
| T3 | 75.04 ±1.52$^{b}$ | 2.38 ±0.20$^{abc}$ | 2.50 ±0.00$^{bcd}$ | 72.68 ±5.66$^{ab}$ | 6.04 ±0.01$^{cde}$ |
| T4 | 73.04 ±0.66$^{d}$ | 2.36 ±0.03$^{abc}$ | 2.51 ±0.02$^{bcd}$ | 77.58 ±3.83$^{ab}$ | 6.09 ±0.00$^{ab}$ |
| T5 | 74.64 ±0.52$^{bc}$ | 2.35 ±0.08$^{abc}$ | 2.58 ±0.02$^{a}$ | 74.87 ±2.41$^{ab}$ | 6.12 ±0.01$^{a}$ |
| T6 | 73.19 ±0.57$^{d}$ | 2.77 ±0.12$^{a}$ | 2.56 ±0.01$^{ab}$ | 79.10 ±2.94$^{a}$ | 6.07 ±0.01$^{bcd}$ |
| T7 | 75.44 ±0.34$^{b}$ | 1.90 ±0.22$^{cd}$ | 2.46 ±0.00$^{d}$ | 71.83 ±1.73$^{ab}$ | 6.02 ±0.01$^{de}$ |
| T8 | 74.73 ±0.32$^{bc}$ | 1.75 ±0.13$^{d}$ | 2.40 ±0.01$^{e}$ | 77.03 ±3.01$^{ab}$ | 6.00 ±0.03$^{ef}$ |

*Control: NaCl 1.5% + STPP 0.2%, T1: Control + Chicory fiber 1%, T2: Control + Chicory fiber 3%, T3: Control + Wheat fiber 1%, T4: Control + Wheat fiber 3%, T5: Control + Brown rice bran fiber 1%, T6: Control + Brown rice bran fiber 3%, T7: Control + Indigestible maltodextrin 1%, T8: Control + Indigestible maltodextrin 3%

1)WHC: water-holding capacity, 2)NA: Non-addition

a-fMeans±SD with different superscripts in the same column differ significantly($p < 0.05$).

Table 4 showed the effects of dietary fiber on emulsion stability and cooking loss of blended pork meat. The treatments with various dietary fibers decreased moisture, fat total isolation and cooking loss compared to NA and control. Similar results were observed for meat batters containing dietary fiber extracted from rice bran (Choi *et al*., 2007).

## IV. CONCLUSION

The results of this study suggest that the addition of various dietary fibers improved the quality characteristics and texture profile analysis of blended pork meat. In proximate analysis, the addition of various dietary fibers showed lower moisture values than NA. Further, the addition of

various dietary fibers into blended pork meat resulted in higher water-holding capacity values and higher texture profile analysis than in NA and control. In the dietary fibers, no differences were observed in emulsion stability and cooking loss. As a result, the addition of various dietary fibers had a positive effect on blended pork meat.

Table 3. Texture profile analysis of blended pork meat following addition of dietary fibers

| Treatments* | Springiness (%) | Cohesiveness (%) | Chewiness (kg) | Hardness (kg) |
|---|---|---|---|---|
| NA[1)] | 37.71±9.03$^{d}$ | 36.46±5.75$^{c}$ | 0.02±0.00$^{e}$ | 0.07±0.02$^{e}$ |
| Control | 74.04±7.25$^{bc}$ | 41.61±7.27$^{c}$ | 0.13±0.05$^{de}$ | 0.97±0.48$^{de}$ |
| T1 | 81.67±7.30$^{ab}$ | 62.06±8.47$^{a}$ | 0.31±0.09$^{ab}$ | 3.02±0.96$^{a}$ |
| T2 | 83.23±5.75$^{ab}$ | 57.22±11.34$^{ab}$ | 0.24±0.09$^{abcd}$ | 1.99±0.86$^{abcd}$ |
| T3 | 80.77±5.36$^{ab}$ | 60.31±7.62$^{a}$ | 0.21±0.03$^{bcd}$ | 1.77±0.39$^{bcd}$ |
| T4 | 78.57±5.44$^{abc}$ | 58.28±8.17$^{ab}$ | 0.26±0.08$^{abc}$ | 2.12±0.76$^{abc}$ |
| T5 | 77.53±9.72$^{abc}$ | 58.49±11.07$^{ab}$ | 0.21±0.12$^{bcd}$ | 1.67±1.31$^{bcd}$ |
| T6 | 69.29±8.30$^{c}$ | 45.49±8.45$^{bc}$ | 0.16±0.05$^{cd}$ | 1.12±0.41$^{cde}$ |
| T7 | 85.24±1.30$^{a}$ | 57.85±4.98$^{ab}$ | 0.36±0.07$^{a}$ | 3.07±0.65$^{a}$ |
| T8 | 80.81±3.53$^{ab}$ | 49.30±5.73$^{abc}$ | 0.31±0.05$^{ab}$ | 2.53±0.53$^{ab}$ |

*Control: NaCl 1.5% + STPP 0.2%, T1: Control + Chicory fiber 1%, T2: Control + Chicory fiber 3%, T3: Control + Wheat fiber 1%, T4: Control + Wheat fiber 3%, T5: Control + Brown rice bran fiber 1%, T6: Control + Brown rice bran fiber 3%, T7: Control + Indigestible maltodextrin 1%, T8: Control + Indigestible maltodextrin 3%

1)NA: Non-addition.

a-eMeans±SD with different superscripts in the same column differ significantly($p < 0.05$).

Table 4. Emulsion stability (mL) and cooking loss (%) of blended pork meat following addition of dietary fibers

| Treatments* | Mojsture Isolation | Fat Isolation | Total Isolation | Cooking loss |
|---|---|---|---|---|
| NA[1)] | 10.02±1.99$^{a}$ | 1.56±0.13$^{a}$ | 11.59±2.08$^{a}$ | 7.05±1.36$^{a}$ |
| Control | 3.12±1.66$^{b}$ | 0.56±0.37$^{b}$ | 3.69±2.03$^{b}$ | 2.60±1.11$^{b}$ |
| T1 | 2.96±0.48$^{b}$ | 0.31±0.06$^{b}$ | 3.28±0.43$^{b}$ | 2.38±0.33$^{b}$ |
| T2 | 3.03±0.13$^{b}$ | 0.48±0.04$^{b}$ | 3.52±0.16$^{b}$ | 2.58±0.15$^{b}$ |
| T3 | 2.48±0.50$^{b}$ | 0.41±0.02$^{b}$ | 2.90±0.53$^{b}$ | 1.97±0.26$^{b}$ |
| T4 | 1.92±0.06$^{b}$ | 0.23±0.07$^{b}$ | 2.16±0.13$^{b}$ | 1.64±0.23$^{b}$ |
| T5 | 2.44±0.51$^{b}$ | 0.40±0.02$^{b}$ | 2.85±0.54$^{b}$ | 1.96±0.26$^{b}$ |
| T6 | 1.56±0.86$^{b}$ | 0.28±0.10$^{b}$ | 1.85±0.96$^{b}$ | 1.63±0.45$^{b}$ |
| T7 | 1.95±0.12$^{b}$ | 0.25±0.18$^{b}$ | 2.20±0.30$^{b}$ | 1.73±0.11$^{b}$ |
| T8 | 1.96±0.03$^{b}$ | 0.20±0.02$^{b}$ | 2.17±0.05$^{b}$ | 1.78±0.08$^{b}$ |

*Control: NaCl 1.5% + STPP 0.2%, T1: Control + Chicory fiber 1%, T2: Control + Chicory fiber 3%, T3: Control + Wheat fiber 1%, T4: Control + Wheat fiber 3%, T5: Control + Brown rice bran fiber 1%, T6: Control + Brown rice bran fiber 3%, T7: Control + Indigestible maltodextrin 1%, T8: Control + Indigestible maltodextrin 3%

1)NA: Non-addition.

a-bMeans±SD with different superscripts in the same column differ significantly($p < 0.05$).


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