# EVALUATION OF RHEOLOGICAL PROPERTIES OF PORK MYOFIBRILLAR PROTEIN GEL AND PRODUCT QUALITY OF LOW-FAT MODEL SAUSAGES ADDED WITH *RHYNCHOSIA NULUBILIS* POWDER WITH DIFFERENT DRYING METHODS AND EXTRACTED PROTEIN

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## I. INTRODUCTION

Myofibrillar protein (MP) is generally extracted in intermediate or high-ionic-strength buffer and is important for the product quality of meat and meat products [1, 2]. Adult diseases have been increased as the amount of fat consumed as food has increased [4], and, currently, demand for health functional foods such as low-fat, low-salt meat products have been increasing [3]. *Rhynchosia nulubilis(RN)* is a type of black soybean and has high protein and fat content [5], which might be useful for the manufacture of comminuted meat products. However, not many studies were performed on the use of RN in meat application. Thus, this study was performed to investigate the quality characteristics of myofibrillar protein and low-fat sausages with *Rhynchosia nulubilis* powder (*RNP*) at different drying methods and extracted protein.

## II. MATERIALS AND METHODS

*Rhynchosia nulubilis* powder (*RNP*) was prepared in two drying methods, freeze drying and oven drying, and extracted protein. Pork loin was used for MP extraction, and pork ham was used for low-fat model sausage production. Two experiments were performed; 1) the rheological properties of MP gels with *RNP* and extracted protein, and 2) the physicochemical properties of low-fat model sausages with RNP and extracted protein. In first experiment, cooking yield (%), gel strength(gf), and viscosity values of myofibrillar protein were measured as affected by different drying methods and extracted protein. pH and colour values, proximate analysis, expressible moisture (EM, %), cooking loss (CL, %), and textural profile analysis were measured in 2nd experiment. The experiment design was one-way analysis of variance and Duncan's multiple comparison was performed at a significant level of 0.05.

## III. RESULTS AND DISCUSSION

As shown in Figure 1, cooking yields (%) of FP and EP were higher than those of CTL (P<0.05), whereas gel strength(gf) of CTL was higher than that of EP (P<0.05). However, the viscosity didn't differ among the treatments (P>0.05).

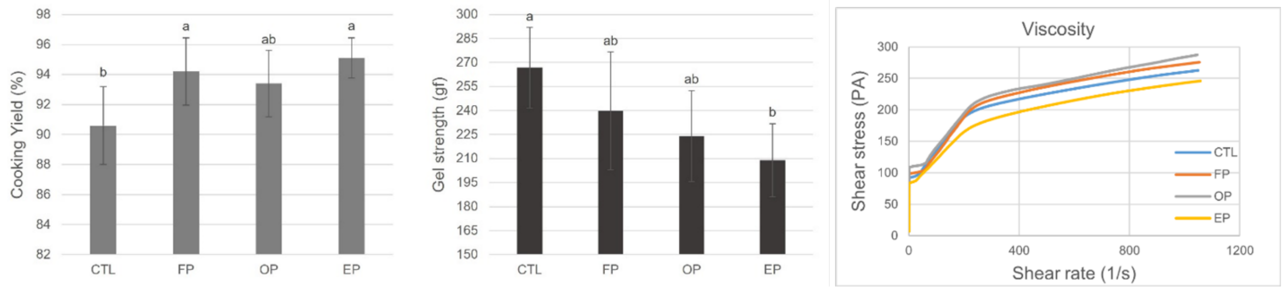


Figure 1. Cooking yield (%), gel strength (gf) and viscosity of MP gels as affected by different drying methods and extracted protein. Treatments: CTL, pork myofibrillar protein (MP) control; FP, MP added with 1.0% freeze dried RNP; OP, MP added with oven dried RNP; EP, MP added with 1.0% protein extract of RNP.

[a, b]Means having same superscripts in a same column are not different (p>0.05).

In Table 1, pH and *L** values were the lowest in EPPS, and *a** values of the sausages with *RNP* and REF were lower than those of CTL, whereas *b** values of the sausages with *RNP* and REF were higher than those of CTL (P<0.05). In proximate analysis, sausages with *RNP* had higher protein contents (%) than the CTL, but lower than REF due to the original protein contents of the powders.

Table 1. pH, coluor values (*L**, *a**, *b**), and proximate analysis of low-fat model sausages with *Rhynchosia nulubilis* powder with different drying methods and extracted protein.

| Treatment | pH | *L** | *a** | *b** | Moisture (%) | Crude fat (%) | Crude protein (%) |
|---|---|---|---|---|---|---|---|
| CTL | 6.29$^{a}$ | 67.4$^{a}$ | 9.20$^{a}$ | 6.34$^{d}$ | 79.9$^{a}$ | 2.04$^{b}$ | 14.3$^{c}$ |
| REF | 6.31$^{a}$ | 67.4$^{a}$ | 8.45$^{b}$ | 7.21$^{b}$ | 79.2$^{a}$ | 2.54$^{a}$ | 16.4$^{a}$ |
| FPPS | 6.30$^{a}$ | 67.3$^{a}$ | 5.77$^{e}$ | 6.57$^{c}$ | 79.6$^{a}$ | 2.13$^{b}$ | 15.6$^{b}$ |
| OPPS | 6.30$^{a}$ | 67.3$^{a}$ | 6.13$^{d}$ | 6.72$^{c}$ | 79.7$^{a}$ | 2.75$^{a}$ | 15.5$^{b}$ |
| EPPS | 6.21$^{b}$ | 65.3$^{b}$ | 8.01$^{c}$ | 7.98$^{a}$ | 79.8$^{a}$ | 1.99$^{b}$ | 15.7$^{b}$ |
| [1]SEM | 0.01 | 0.23 | 0.36 | 0.16 | 0.17 | 0.09 | 0.19 |
| P values | 0.001 | <0.001 | <0.001 | <.001 | 0.848 | 0.001 | <0.001 |

[a-e] Means having same superscripts in a same column are not different (P>0.05). [1]SEM: standard error of the mean (n=3).

As shown in Table 2, CLs (%) of sausages with *RNP* were lower than those of REF and CTL, however, CTL had higher EM (%) than the FPPS and OPPS, but lower than REF and EPPS (P<0.05). In textural profile analysis, sausages with REF and OPPS had similar textural hardness to the CTL, whereas those with FPPS and EPPS was lower hardness than the CTL, indicating that oven dried *RNP* had similar textural hardness to the REF(SPI).

Table 2. EM, CL, and textural properties of low-fat model sausages added with different drying methods and protein extract of *Rhynchosia nulubilis* powder.

| Treatment | Cooking loss (CL, %) | Expressible moisture (%) | Hardness (gf) | Springiness (mm) | Gumminess | Chewiness | Cohesiveness |
|---|---|---|---|---|---|---|---|
| CTL | 1.63$^{a}$ | 23.8$^{b}$ | 4214$^{a}$ | 5.60$^{a}$ | 33.4$^{a}$ | 190$^{a}$ | 0.81$^{a}$ |
| REF | 0.85$^{b}$ | 26.9$^{a}$ | 3951$^{ab}$ | 5.74$^{a}$ | 30.2$^{a}$ | 178$^{a}$ | 0.81$^{a}$ |
| FPPS | 0.75$^{c}$ | 22.6$^{bc}$ | 3726$^{b}$ | 5.36$^{a}$ | 32.8$^{a}$ | 187$^{a}$ | 0.89$^{a}$ |
| OPPS | 0.70$^{c}$ | 22.2$^{c}$ | 4011$^{ab}$ | 5.33$^{a}$ | 32.6$^{a}$ | 183$^{a}$ | 0.86$^{a}$ |
| EPPS | 0.54$^{d}$ | 27.3$^{a}$ | 3870$^{b}$ | 5.83$^{a}$ | 30.7$^{a}$ | 176$^{a}$ | 0.82$^{a}$ |
| [1]SEM | 0.10 | 0.59 | 56.0 | 0.92 | 0.73 | 2.29 | 0.01 |
| P-values | <0.0001 | <0.0001 | 0.045 | 0.233 | 0.649 | 0.290 | 0.168 |

[a-d] Means having same superscripts in a same column are not different (P>0.05). [1]SEM: standard error of the mean (n=3).

## IV. CONCLUSION

Adding oven dried *RNP*s into low-fat model sausages could be effectively used as a fat replacer since they had similar characteristics to those with REF(SPI), in terms of water holding capacity and textural properties. The reduced a* values of the sausages with oven dried *RNP*s will be compensated to meet a consumer's demand in the future study.

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