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IMPACT OF *MAGNOLIA DENUDATA* EXTRACT ON THE OXIDATIVE STABILITY OF CHICKEN SAUSAGE

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I. INTRODUCTION

Recently, the meat processing industry has continued to develop various meat processing products using natural functional materials to meet consumer satisfaction and needs [5].
Magnolia denudata has been reported to have phenolic compounds such as flavonoid and polyphenol with antioxidant effects [3], and the addition of these food materials has extended the storage period and improved the quality [4]. Therefore, this study was conducted to confirm the possibility of food materials of *Magnolia denudata*.

II. MATERIALS AND METHODS

Freeze-dried *Magnolia denudata* extract was prepared by extracting dried flowers with 80% ethanol at 37°C for one week, followed by filtration, concentration, and freeze-drying at -40°C for 12 hours. The obtained extract was then used for 1-picrylhydrazy (DPPH), total polyphenol contents (TPC), and total flavonoid contents (TFC) experiments. Emulsion-type chicken breast sausages were prepared using pork backfat and crushed ice, with *Magnolia denudata* extract (MDE) at concentrations of 0.1% (T1), 0.15% (T2), and 0.2% (T3). The mixture was emulsified, filled into conical tubes, cooked at 80°C for 30 minutes, and stored at 4°C for two weeks. The storage characteristics of the MDE-treated sausages were compared with a control group containing ascorbic acid (PC) and a negative control without any added extract (NC). The assesments included storage characteristcs, including pH, thiobarbituric acid reactive substance (TBARS), and volatile basic nitrogen (VBN). All experiments were conducted in triplicate.

III. RESULTS AND DISCUSSION

Table 1 shows an antioxidant capacity of 44.48%, a total polyphenol content of 132.91 mg GAE/g, and a total flavonoid content of 42.44 mg NE/g.

Table 1. 1-picrylhydrazy (DPPH), total polyphenol contents (TPC), and total flavonoid contents (TFC) of *Magnolia denudate* extract

Traits[1)]	*Magnolia denudate* Extract
DPPH (%)	44.48±0.01
TPC (mg GAE/g)	132.91±0.97
TFC (mg NE/g)	42.44±1.27

[1)]GAE: gallic acid equivalents, NE: naringin acid equivalents

Table 2 shows pH of chicken breast sausage. The addition of *Magnolia denudata* extract significantly increased pH ($p < 0.05$), likely due to polyphenol and flavonoid interactions with proteins [1]. While pH increased in all groups during storage, NC and PC showed greater rises by day 7, whereas antioxidant compounds in T2 and PC appeared to stabilize pH changes over time [2].

Table 2. pH of chicken breast sausage formulated with various levels of *Magnolia denudate* extract during storage

Storage period	NC	PC	T1	T2	T3
1day	$6.27±0.02^{Bb}$	$6.19±0.02^{Bc}$	$6.34±0.02^{Ca}$	$6.33±0.01^{Ba}$	$6.32±0.01^{Ca}$
7day	$6.42±0.01^{Ab}$	$6.31±0.03^{Ad}$	$6.44±0.01^{Aa}$	$6.36±0.01^{Ac}$	$6.41±0.02^{Ab}$
14day	$6.39±0.03^{Aab}$	$6.21±0.02^{Bd}$	$6.4±0.01^{Ba}$	$6.32±0.01^{Bc}$	$6.36±0.01^{Bb}$

NC, no addition; PC, Ascorbic acid 0.1%; T1, *Magnolia denudate* extract 0.1%; T2, *Magnolia denudate* extract 0.15%; T3, *Magnolia denudate* extract 0.2%. Means in the same row (a-d) and column (A-C) with different letters are significantly different ($p<0.05$). All values are mean±standard error.

Table 3 shows TBARS of chicken breast sausage. The addition of *Magnolia denudata* extract effectively inhibited fat oxidation in meat products during storage. The NC group showed the highest TBARS values at all time points ($p < 0.05$), while the T3 group exhibited the lowest oxidation at week 1. As the *Magnolia denudata* extract increased, especially 2%, were the most effective in reducing fat oxidation.

Table 3. Thiobarbituric acid reactive substance of chicken breast sausage formulated with various levels of *Magnolia denudate* extract during storage periods (Unit: mg malondiadehyde/kg)

Storage period	NC	PC	T1	T2	T3
1day	0.22 ± 0.02^{Ca}	0.06 ± 0.01^{Bb}	0.01 ± 0.01^{b}	0.1 ± 0.02^{Cb}	0.07 ± 0.01^{Bb}
7day	0.45 ± 0.02^{Aa}	0.11 ± 0.01^{ABc}	0.13 ± 0.03^{b}	0.14 ± 0.01^{Bb}	0.09 ± 0.02^{Bd}
14day	0.37 ± 0.06^{Ba}	0.12 ± 0.05^{Ac}	0.13 ± 0.04^{bc}	0.17 ± 0.01^{Ab}	0.13 ± 0.02^{Abc}

NC, no addition; PC, Ascorbic acid 0.1%; T1, *Magnolia denudate* extract 0.1%; T2, *Magnolia denudate* extract 0.15%; T3, *Magnolia denudate* extract 0.2%. Means in the same row (a-d) and column (A-C) with different letters are significantly different ($p<0.05$). All values are mean±standard error.

Table 4 shows VBN of chicken breast sausage. The addition of *Magnolia denudata* demonstrated an inhibitory effect on protein degradation by lowering the VBN levels during storage. Notably, the lowest VBN value was observed at the 2% concentration (T3), and although the VBN levels increased over time, T3 consistently maintained lower values compared to the NC.

Table 4. Volatile basic nitrogen of chicken breast sausage formulated with various levels of *Magnolia denudate* extract during storage periods

Storage period	NC	PC	T1	T2	T3
1day	7.00 ± 0.37^{a}	6.36 ± 0.38^{b}	6.92 ± 0.27^{a}	6.16 ± 0.27^{Bb}	5.59 ± 0.24^{Bc}
7day	7.19 ± 0.38^{a}	6.43 ± 0.51^{bc}	7.02 ± 0.48^{a}	6.72 ± 0.37^{ABab}	6.06 ± 0.48^{ABc}
14day	6.87 ± 0.14^{ab}	6.4 ± 0.43^{bc}	7.19 ± 0.38^{a}	6.75 ± 0.58^{Aabc}	6.27 ± 0.35^{Ac}

NC, no addition; PC, Ascorbic acid 0.1%; T1, *Magnolia denudate* extract 0.1%; T2, *Magnolia denudate* extract 0.15%; T3, *Magnolia denudate* extract 0.2%. Means in the same row (a-d) and column (A-C) with different letters are significantly different ($p<0.05$). All values are mean±standard error.

CONCLUSION

This study evaluated the antioxidant effects of *Magnolia denudata* extract on chicken breast sausage during refrigerated storage. The extract showed high antioxidant capacity and inhibited fat oxidation, delayed acidification, and reduced protein degradation, particularly at a 0.2% concentration. These findings suggest that *Magnolia denudata* extract is an effective natural antioxidant to enhance the quality and storage stability of sausages.

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