THE EFFECT OF *Ganghwayakssuk* (*Artemisia princepes* Pamp.) EXTRACTS ON THE ANTIOXIDANT ACTIVITY OF CHICKEN NUGGET BATTERS

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Abstract— effects of the *Ganghwayakssuk* (*Artemisia princepe*s Pamp.) extracts on the antioxidant activity of chicken nugget batters were investigated at the following different concentrate level of ethanolic extracts of *Ganghwayakssuk*: control (without *Ganghwayakssuk* extracts), T1 (50% ethanolic *Ganghwayakssuk* extracts), T2 (75% ethanolic *Ganghwayakssuk* extracts). Lipid oxidation of the chicken nugget batters were analyzed during the storage for 9 days at 4°C. The pH values of the chicken nugget batters containing *Ganghwayakssuk* extracts were higher than the control on 0, 5, and 9 days. The TBARS values of the T1 and T2 groups were lower than the control. Also, the VBN values were lower than the control at the end of the refrigerated storage period. The total bacterial count was lower in T1 and T2 than the control. These results suggest that addition of *Ganghwayakssuk* extracts is helpful to improve the quality of chicken nugget batters.

***Keywords* — *Ganghwayakssuk* (*Artemisia princepes Pamp.*), chicken nugget batter, lipid oxidation.**

I. INTRODUCTION

Lipid oxidation is one of the main factors in the estimation of quality due to the susceptibility of meats and meat products to oxidative degeneration (Lee et al., 2010). Antioxidants are categorized as efficient compounds of delaying, retarding, or preventing autoxidation processes (Hongxia & Hongjun, 2007). Synthetic antioxidants such as butylated hydroxytoluene (BHT) and butylated hydroxyanisole (BHA) are commonly used as food preservatives (Verhagen, Deerenberg, Marx, ten Hoor, Henderson, & Kleinjans, 1990). However, the application of such synthetic antioxidants has been connected with potential health (Hettiarachchy, Glenn, Gnanaesbandam, & Johnson, 1996). Accordingly, meats and meat products are practical needs for the screening and selection of natural antioxidants as effective alternatives in the prevention of food deterioration (Kikuzaki & Nakatani, 1993). *Ganghwayakssuk* (*Artemisia princepes* Pamp.) consist of bio-active compounds such as phenolic compounds, alkaloids, vitamin A, B_1, B_2, C and various minerals (Choi, Lee, & Bang, 2005). Therefore, the aims of the present work were to investigate the effects of *Ganghwayakssuk* extracts on the lipid oxidation of chicken nugget batters during the refrigerated storage period.

II. MATERIALS AND METHODS

A. Preparation of Ganghwayakssuk extract

Dried *Ganghwayakssuk* leaves (30 g) were extracted with 600 ml of 50% and 75% ethanol overnight in a shaker at room temperature. The extract was filtered through 0.45 μm filter membrane and evaporated with a rotary evaporator (EYELA N-1000, RIKAKIKAI. Co. Ltd., Japan) below 50°C.

B. Chicken batter preparation and processing

Fresh chicken breast and pork back fat were purchased from a local market. Chicken breast meats and pork back fat were initially ground through an 8 mm plate. The ground tissue was then placed in polyethylene bags, vacuum sealed using a vacuum packaging system and stored at 0°C until required for product manufacturing. Suitable amounts of muscle and fat were stored at 4°C for 24 h. Chicken nugget batters were processed based on the following formulation: 60% chicken breast meat, 20% pork back fat, 20% ice, 1.5% sodium chloride, and 0.15% phosphate. The control was manufactured without *Ganghwayakssuk* extract. Treatments contained different concentrate level of ethanolic extracts on *Ganghwayakssuk* in the final chicken nugget batter: each 0.2% (50% or 75% ethanolic *Ganghwayakssuk* extracts).

Three samples were taken at each selected time (0, 5, and 9 days) for subsequent analysis.

C. pH

The pH of sample was determined with a pH meter (Model 340, Mettler-Toledo GmbH, Schwerzenbach, Switzerland). The pH values were measured by blending a 5 g sample with 20 ml distilled water for 60 s in a homogenizer.

D. Thiobarbituric acid reacting substances (TBARS)

The TBARS values were expressed as mg malonaldehyde/kg samples and estimated colorimetrically using 2-thiobarbituric acid (Tarladgis et al., 1960). The absorbance was measured at 538 nm with UV spectrophotometer (Brochrom, Libra S22, England). The K value was calculated as described by Tarladgis et al (1960) using 1,1,3,3-tetraethoxypropane (Sigma) as the standard and the TBARS values were calculated by multiplying the absorbance values by the K value.

E. Volatile basic nitrogen (VBN)

The Volatile basic nitrogen (mg/%) test was performed to determine the extent of protein deterioration during refrigerated storage. The VBN was measured by the modified micro diffusion assay according to the method of Pearson (1968).

F. Microbiological evaluations

To measure the microbial quality of the samples, duplicate packs from each treatment were taken, 10 g samples of the chicken nugget batters were aseptically transferred into a sterile stomacher bag and 90 ml of sterile 0.1% peptone water (Difco Laboratories, Detroit, MI, USA) was added to each sample and macerated for 2 min in a stomacher. A decimal serial dilution in 0.1% peptone water was prepared. Mesophillic microorganisms were determined using Plate Count Agar at 35˚C for 48 h. Microbial colonies were counted and expressed as colony forming units (cfu) per gram.

III. RESULTS AND DISCUSSION

The pH values of chicken nugget batters containing different concentrate level of ethanolic extracts on *Ganghwayakssuk* are shown in Fig. 1. The pH values were higher than the control on 0, 5, and 9 days. The pH values were affected by *Ganghwayakssuk* extracts because the pH values of *Ganghwayakssuk* extracts were higher than raw meat. The effects of *Ganghwayakssuk* extracts on the TBARS values of chicken nugget batters during 9 days of refrigerated storage are shown in Fig. 2. The initial TBARS values were not generally different among the control and all treatments nugget batters. The TBARS values of all treatments were lower than the control at the end of the refrigerated storage period indicating that *Ganghwayakssuk* extracts may prevent lipid oxidation in chicken nugget batters. The VBN could be used as a quality indicator and is associated with the amino acid decarboxylase activity of microorganism during storage. Fig. 3 shows the changes in the VBN values during refrigerated storage. The VBN values of all treatments were lower than the control at the end of the refrigerated storage period. The results of microbiological analyses of the chicken nugget batters containing *Ganghwayakssuk* extracts during the 9 days refrigerated storage period showed in Fig. 4. The total bacterial count increased throughout storage in the control. All treatments generally had lower bacterial counts than the control.

IV. CONCLUSION

In the present study, it was found that *Ganghwayakssuk* extracts were potential sources of antioxidant components. All treatments were effective antioxidant in chicken nugget batters having lower TBARS values than the control during refrigerated storage at 4˚C for 9 days. Also, there was no significant difference between T1 (50% ethanolic *Ganghwayakssuk* extracts) and T2 (75% ethanolic *Ganghwayakssuk* extracts) in chicken nugget batters. Therefore, it is important to consider the bioavailability of *Ganghwayakssuk* for utilization in food systems. In addition to being used as healthy antioxidants, the compounds present in *Ganghwayakssuk* that are responsible for antioxidant activity could be utilized as food additives to delay the oxidative deterioration of meats and meat products.

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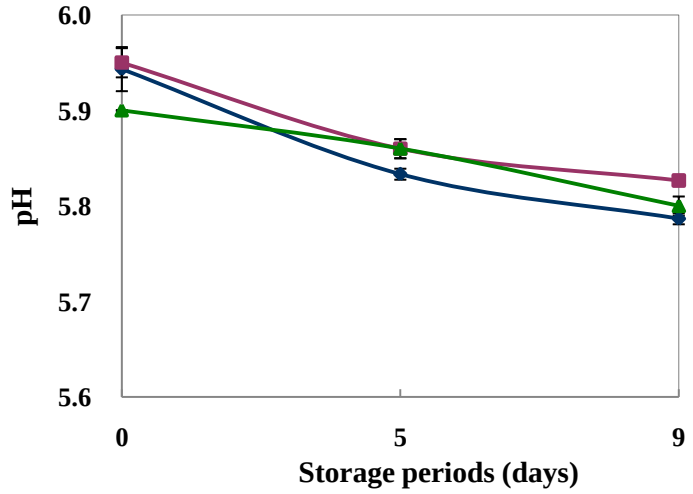

Fig. 1. Change of pH values on chicken nugget batter with containing *Ganghwayakssuk* extracts during refrigerated storage (4±1 ˚C). (■) Con: chicken nugget batter without *Ganghwayakssuk* extracts, (◆) T1: chicken nugget batter with 50% *Ganghwayakssuk* ethanolic extracts, (▲) T2: chicken nugget batter with 75% *Ganghwayakssuk* ethanolic extracts.

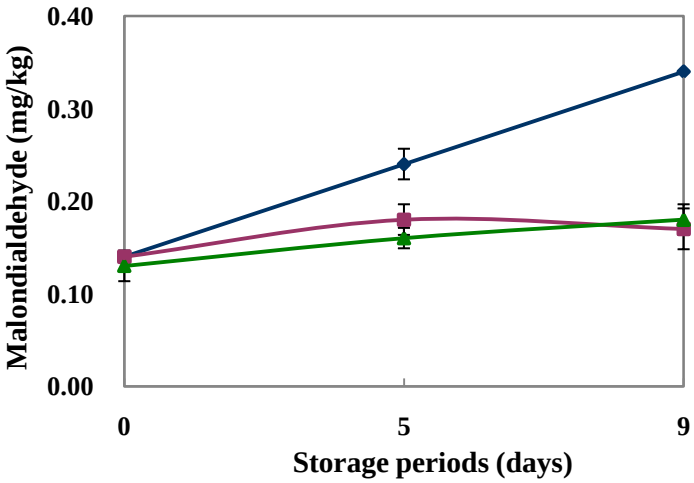

Fig. 2. Change of TBARS values on chicken nugget batter with containing *Ganghwayakssuk* extracts during refrigerated storage (4±1 ˚C). (■) Con: chicken nugget batter without *Ganghwayakssuk* extracts, (◆) T1: chicken nugget batter with 50% *Ganghwayakssuk* ethanolic extracts, (▲) T2: chicken nugget batter with 75% *Ganghwayakssuk* ethanolic extracts.

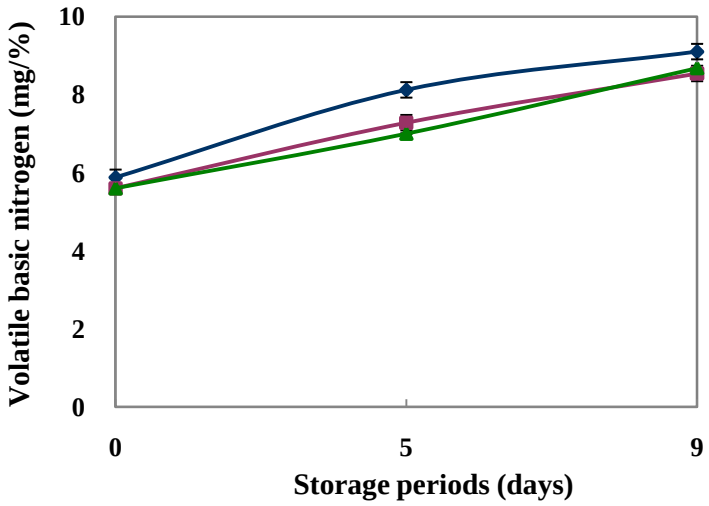

Fig. 3. Change of VBN on chicken nugget batter with containing *Ganghwayakssuk* extracts during refrigerated storage (4±1 ˚C). (■) Con: chicken nugget batter without *Ganghwayakssuk* extracts, (◆) T1: chicken nugget batter with 50% *Ganghwayakssuk* ethanolic extracts, (▲) T2: chicken nugget batter with 75% *Ganghwayakssuk* ethanolic extracts.

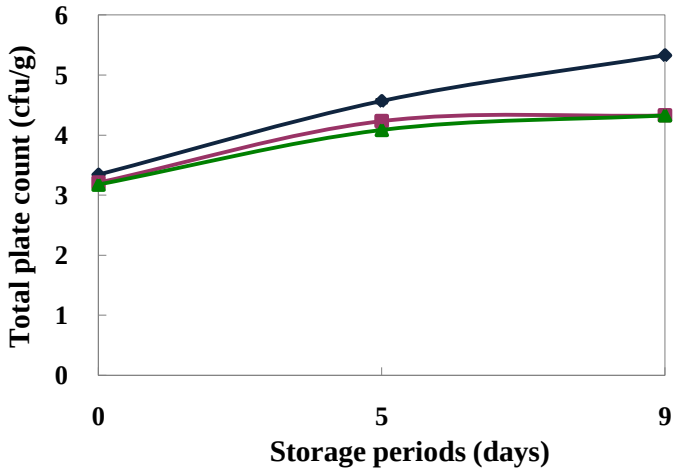

Fig. 4. Change of total plate count on chicken nugget batter with containing *Ganghwayakssuk* extracts during refrigerated storage (4±1 ˚C). (■) Con: chicken nugget batter without *Ganghwayakssuk* extracts, (◆) T1: chicken nugget batter with 50% *Ganghwayakssuk* ethanolic extracts, (▲) T2: chicken nugget batter with 75% *Ganghwayakssuk* ethanolic extracts.