

EVALUATION OF ANTIOXIDATIVE AND ANTIMICROBIAL ACTIVITY OF *Houttuynia cordata*, *Toona sinensis* AND *Arctium lappa* IN FRESH CHICKEN SAUSAGE DURING STORAGE AT 2-4°C

D. C. Liu^{1*}, B. Y. Yung¹, C. H. Lin¹, C. W. Shih¹, Y. H. Chen¹, S. W. Chen¹, and J. H. Liu¹

¹Department of Animal Science, National Chung Hsing University, 250 Kao Kuang Rd Taichung 40227, Taiwan ROC

*Corresponding author (phone: +886-4-22872622; fax: +886-4-22860265; e-mail: dcliu@dragon.nchu.edu.tw)

Abstract—Crude fat of fresh chicken sausages with 3% Chinese mahogany and burdock, individually, were significantly lower than the control and fish wort ($P < 0.05$). At the same time, moisture and crude protein in Chinese mahogany was significantly higher than with the control, fish wort and burdock. pH values in all fresh chicken sausages decreased with storage time and at the 7th day fresh chicken sausage with Chinese mahogany significantly went down to pH 4.8 then kept this pH value still to the end of storage (14 days). We also found during the whole storage, herbs didn't demonstrate better antioxidative activity. With storage time, VBN in all fresh chicken sausages were gradually increased and 3% Chinese mahogany showed significantly lower than the control, burdock and fish wort at the final day. The total plate counts in all samples increased with storage time and the results also displayed fish wort had better antibacterial activity than the other two herbs. On sensory panel, fresh chicken sausage with fish wort and the control had higher score in appearance, flavor and overall acceptance at the initial day and then but lower in off-odor before 7 days during storage. However, 3% fish wort was suitable and has a better quality in fresh chicken sausage in comparison with the other two herbs in this study.

Key words: Fish wort, Chinese mahogany, burdock, fresh chicken sausage

I. INTRODUCTION

Fish wort (*Houttuynia cordata* Thunb) is both a medical plant and an edible plant in Taiwan. Traditional Chinese medicines (TCMs) have been widely applied to treat various diseases for more than 8000 years in China (Dražar and Moravcova, 2004). Recently, it was gaining increasing popularity worldwide for health promotion and adjuvant therapy. (Xu *et al.*, 2006; Zheng *et al.*, 1998; Xiao *et al.*, 1996; Liao *et al.*, 2002).

Chinese mahogany, also known as *Toona sinensis* Roem, is a perennial tree that has become widely grown in Taiwan and China (Edmonds & Staniforth, 1998). Hseu *et al.* (2008) reported that *T. sinensis* aqueous extracts showed some antioxidant activities, including the scavenging of free and superoxide anion radicals, reducing power and metal chelation. Methanol extracts of *T. sinensis* also demonstrated strong DPPH radical-scavenging activities and inhibitory effects on lipid peroxidation (Cho *et al.*, 2003). Similarly, some potent antioxidative components in the young leaves and shoots of *T. sinensis* led to a promising health-promoting food (Wang *et al.*, 2007).

Burdock (*Arctium lappa*) is a very popular edible vegetable in Japan called "Gobo", it has been extensively analysed for its reserve and cell-wall polysaccharides (Kato *et al.*, 1991; Fuchigami *et al.*, 1990; Kato *et al.*, 1993; Watanabe *et al.*, 1991), components having antimicrobial activity (Healy *et al.*, 1999) as well as for extractive components with antioxidant activity (Duh *et al.*, 1998).

The aim of this study was to evaluate the herbal antimicrobial and antioxidant ability of fish wort, Chinese mahogany and burdock in fresh chicken sausages stored at 2-4°C. The pH, thiobarbituric acid (TBA) values, volatile basic nitrogen (VBN), and microbial quality were to determine. Moreover, the result of sensory evaluation was also to understand hedonic scale of fresh chicken sausage with these herbs in this study.

II. MATERIALS AND METHODS

Three different fresh herbs (the young leaves and shoots of fish wort- *Houttuynia cordata*, the young leaves and shoots of Chinese mahogany- *Toona sinensis* and burdock- *Arctium lappa*) were obtained from local markets, and then blended with a blender for 1.5 min. Those herbs were stored at 4°C. The frozen chicken meat (breasts and legs), chicken skin, pork backfat and pork casing obtained from local markets. Chicken meat was ground by 9 mm plate, chicken skin and pork backfat by 6mm plate. First, ground chicken meat was mixed 1.6% NaCl and 0.1% polyphosphates for 5 min, and then mixed with spices and seasoning, including 1% sugar, 0.4% MSG, 0.15% white pepper powder, 0.1% onion powder, 0.085% cardamom powder for 3 min. Finally, the meat paste was mixed with 9% chicken skin, 6% pork backfat and 15% ice for 8 min. The meat pastes were divided into four groups as control = non herb, fish wort = 3% fish wort, Chinese mahogany = 3% Chinese mahogany and burdock = 3% burdock, individually. The four meat paste

mixtures were cured at 4°C for 24 hours, and then stuffed (Stuffer, Dick D-73779, Germany) into pork casing and sectioned as 10-12cm length then packed in a tray with PVC film and stored at 2-4°C.

The samples were taken at days 1, 4, 7, 10 and 14 during storage. Chemical content and pH of fresh chicken sausages were determined according to AOAC (1990)'s method. TBA values of the samples were determined according to the methods described by Faustman et al. (1992). Total plate count was performed according to the method of Bacteriological Analytical Manual for Foods (BAM, FDA) (1996). Volatile basic nitrogen was determined by the Conway micropipette diffusion method (CNS, 1982). Sensory attributes, including appearance, off-odour, flavor and overall acceptance were determined using 1-7 point hedonic scale, with 1, 4 and 7 representing extremely dislike, neither like nor dislike and extremely like, respectively. SAS (2003)'s GLM program was used to analyse all data in this study.

III. RESULTS AND DISCUSSION

The chemical composition of fresh chicken sausages with fish wort, Chinese mahogany and burdock were shown as table 1. Crude fat of fresh chicken sausages with 3% Chinese mahogany and burdock, individually, were significantly lower than the control and fish wort ($P < 0.05$). At the same time, moisture and crude protein in Chinese mahogany was significantly higher than with the control, fish wort and burdock. Nevertheless, ash in burdock had the highest value and significantly higher than that in the control, fish wort and Chinese mahogany. In figure 1, pH values in all fresh chicken sausages decreased with storage time and at the 7th day fresh chicken sausage with Chinese mahogany significantly went down to pH 4.8 then kept this pH value still to the end of storage (14 days). We also found during the whole storage, herbs didn't demonstrate better antioxidative activity and the result showed as the TBA of fresh chicken sausages in figure 2. Burdock had higher TBA value in comparison with the control, Chinese mahogany and fish wort. With storage time, VBN in all fresh chicken sausages were gradually increased and 3% Chinese mahogany showed significantly lower than the control, burdock and fish wort at the final day (figure 3). During storage, the total plate counts in all samples increased with storage time. At the initial, the microbial count were not significantly different among all treatments and the control but fresh chicken sausages with fish wort had significant lower counts ($P < 0.05$) when compared with the control, burdock and Chinese mahogany before 10 days during storage (figure 4). The results also displayed fish wort had better antimicrobial activity than the other two herbs. On sensory panel, fresh chicken sausage with fish wort and the control had higher score in appearance, flavor and overall acceptance at the initial day and then but lower in off-odour before 7 days during storage. Therefore, 3% fish wort was suitable and has a better quality in fresh chicken sausage in comparison with the other two herbs in this study.

IV. CONCLUSION

In conclusion, use of 3% fish wort could help to control bacterial quality in fresh chicken sausages and also actually kept better sensory quality when the products stored at 2-4°C for 7 days.

REFERENCES

- A.O.A.C. 1990. Official Methods of analysis. 15th ed. Assoc. Offic. Anal. Chem., Arlington, VA.
- Drašar, P. and J. Moravcova. 2004. Recent advances in analysis of Chinese medical plants and traditional medicines. *Journal of Chromatography B* 812: 3-21.
- Edmonds, J. M. and M. Staniforth. 1998. *Toona sinensis*: Meliaceae. *Curtis's Bot. Mag.* 15: 186-193.
- Hseu, Y. C., W. H. Chang, C. S. Chen, J. W. Liao, C. J. Huang and F. J. Lu. 2008. Antioxidant activities of *Toona sinensis* leaves extracts using different antioxidant models. *Food and Chemical Toxicology* 46(1): 105-114.
- Majhenic, L., M. Skerget and Z. Knez. 2007. Antioxidant and antimicrobial activity of guarana seed extracts. *Food Chemistry* 104: 1258-1268.
- Mata, A. T., C. Proenca, A. R. Ferreira, M. L. M. Serralheiro, J. M. F. Nogueira and M. E. M. Araujo. 2007. Antioxidant and antiacetylcholinesterase activities of five plants used as Portuguese food species. *Food Chemistry* 103: 778-786.
- Wang, K. J., C. R. Yang and Y. J. Zhang. 2007. Phenolic antioxidants from Chinese toon (fresh young leaves and shoots of *Toona sinensis*). *Food Chemistry* 101(1): 365-371.
- SAS. 2003. "SAS/GRAPH user's guide". SAS Institute Inc., Cary, NC.

Table1 Effects of fish wort, Chinese mahogany and burdock on chemical contents of fresh chicken sausage

Items	Control	Fish wort	Chinese mahogany	Burdock
Moisture%	66.56±0.71 ^b	66.36±0.59 ^b	69.09±0.12 ^a	67.18±0.53 ^b
Crude protein%	15.22±0.20 ^c	15.58±0.24 ^{b,c}	16.44±0.64 ^a	16.24±0.47 ^{a,b}
Crude fat %	12.84±0.09 ^a	12.07±0.28 ^b	9.77±0.33 ^c	9.61±0.40 ^c
Ash%	2.37±0.07 ^{a,b}	2.29±0.02 ^b	2.30±0.00 ^b	2.44±0.07 ^a

mean±S.D., n=6.

^{a, b, c} Means within the same row with different superscripts are significantly different (P < 0.05).

Table 2 Effects of fish wort, Chinese mahogany and burdock on sensory panel of chicken sausage during storage at 2-4°C

Items	Control	Fish wort	Chinese mahogany	Burdock
1st day				
Appearance	5.40±0.99 ^a	4.60±0.83 ^{a,b}	4.13±1.68 ^b	4.87±1.25 ^{a,b}
Flavor	5.47±1.19 ^a	4.93±1.39 ^{a,b}	3.93±1.75 ^{b,c}	3.87±1.13 ^c
Off odor	1.20±0.56 ^b	1.67±1.11 ^b	1.87±1.36 ^b	3.07±1.53 ^a
Overall acceptance	5.87±1.06 ^a	5.13±1.41 ^a	3.93±1.62 ^b	3.47±1.13 ^b
7th day				
Appearance	5.27±0.79 ^a	3.64±0.92 ^b	3.36±0.67 ^b	5.00±0.77 ^a
Flavor	4.82±1.25 ^a	4.82±1.47 ^a	3.64±1.80 ^a	3.64±1.21 ^a
Off odor	1.82±0.75 ^a	2.09±1.22 ^a	2.73±1.19 ^a	2.73±1.35 ^a
Overall acceptance	5.18±0.98 ^a	4.36±1.57 ^{a,b}	2.82±1.25 ^{b,c}	3.55±1.44 ^c
14th day				
Appearance	4.90±0.99 ^a	3.80±0.63 ^b	3.00±1.05 ^c	5.10±0.74 ^a
Flavor	-	-	-	-
Off odor	3.10±1.91 ^a	3.70±1.70 ^a	3.40±1.17 ^a	3.60±1.43 ^a
Overall acceptance	4.10±1.66 ^a	3.40±1.35 ^a	3.00±0.94 ^a	3.60±1.43 ^a

mean±S.D., n=9.

^{a, b, c} Means within the same row with different superscripts are significantly different (P < 0.05).

-: no test

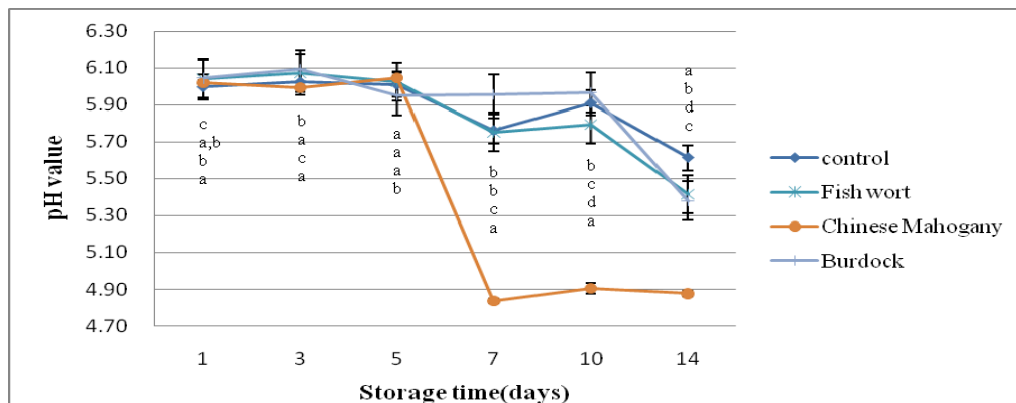


Figure 1 Effects of fish wort, Chinese mahogany and burdock on pH value of fresh chicken sausages during storage at 2-4°C. mean±S.D., n=6.

^{a, b, c} Means within the same row with different superscripts are significantly different (P < 0.05).

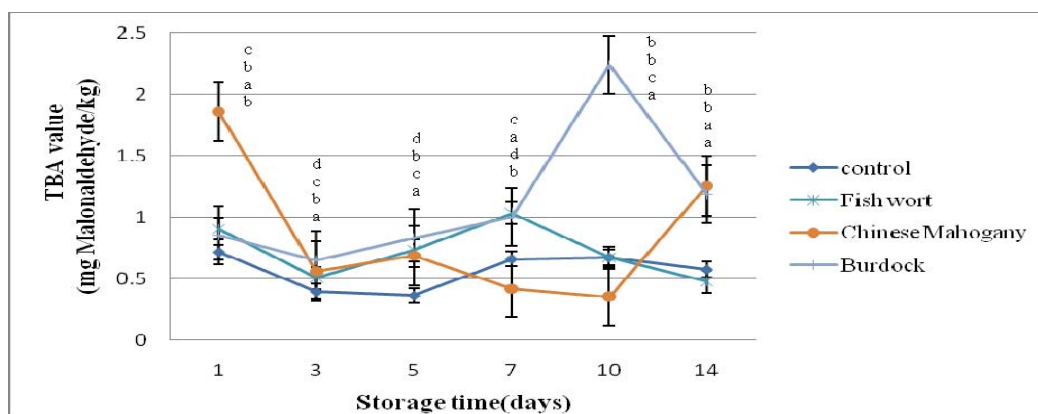


Figure 2. Effect of fish wort, Chinese mahogany and burdock on TBA value of fresh chicken sausages during storage at 2-4°C. mean±S.D., n=6.

a, b, c Means within the same row with different superscripts are significantly different ($P < 0.05$)

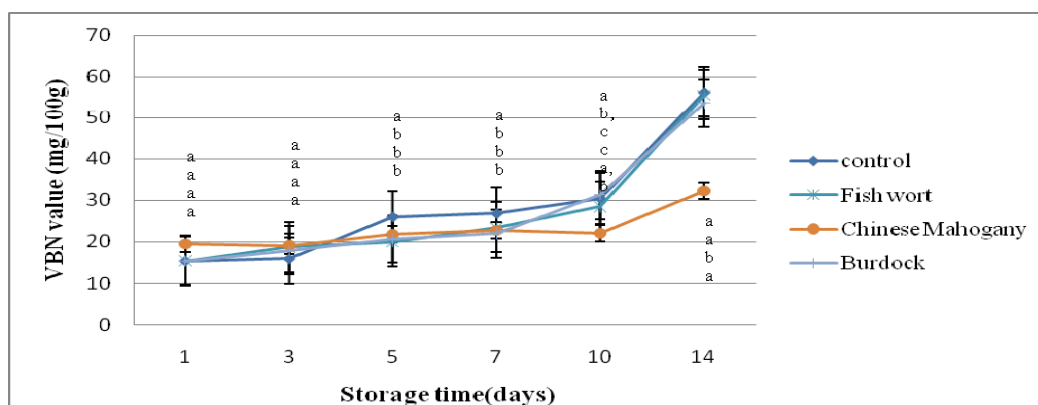


Figure 3. Effect of fish wort, Chinese mahogany and burdock on VBN value of fresh chicken sausages during storage at 2-4°C. mean±S.D., n=6.

a, b, c Means within the same row with different superscripts are significantly different ($P < 0.05$)

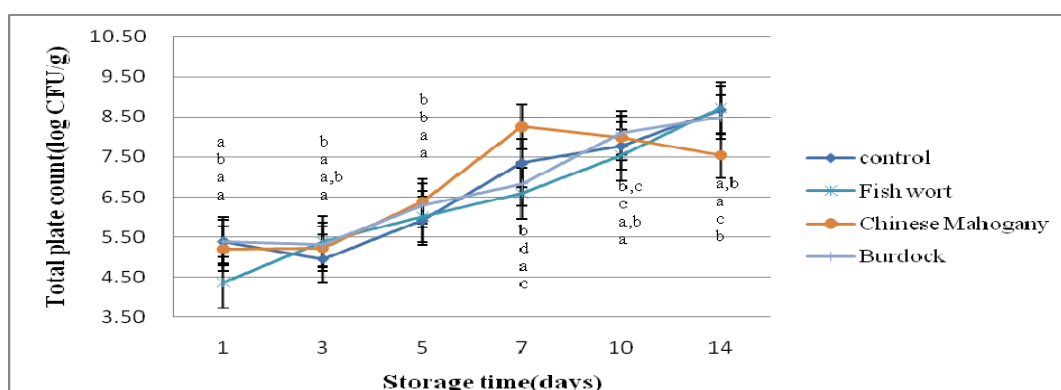


Figure 4. Effect of fish wort, Chinese mahogany and burdock on total plate count of fresh chicken sausages during storage at 2-4°C. mean±S.D., n=6.

a, b, c Means within the same row with different superscripts are significantly different ($P < 0.05$)