EFFECTS OF RENDERING METHODS ON THE YIELD AND QUALITY CHARACTERISTICS OF CHICKEN FAT FROM BROILER SKIN FAT

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Abstract – Broiler skin fat which obtained from a commercial poultry processing plant was rendered using oven rendering (OR), water cooking (WC), low power microwave rendering (LM), and high power microwave rendering (HM). The yield and quality characteristics of rendered fat were determined. The results showed that HM and LM exhibited the highest fat yields, followed by OR and WC. Acid value of broiler skin fat obtained using WC was significantly higher, followed by OR and HM, and finally LM. Acid value of fat increased significantly as the microwave power level increased. No significant difference in peroxide value was detected between treatments. WC sample had the significantly higher TBA values, whereas no significant difference was observed between other treatments. The skin fat obtained by using HM and LM had significantly higher L* values, followed by WC, and OR. Skin fat obtained from WC and OR had significantly higher negative a* values, followed by LM and HM. Significantly higher b* values were observed in the skin fat obtained from HM, followed by LM, WC and OR.

Key Words – Broiler skin, Fat, Rendering, Microwave

I. INTRODUCTION

The demand of poultry meat has increased rapidly for years. Many by-products, such as skin and abdominal fat, are produced during the manufacturing of poultry meat. How to utilize these animal by-products probably and even increase their values as possible become critical for the poultry industry. Chicken fat can be applied as cooking oil as well as to increase the flavors of foods. Rendering is referred to the processing which utilizes animal fatty tissue to manufacture purified fats and oils. There are various rendering methods, such as dry rendering, wet rendering, frying and etc. Sheu and Chen (2002) found that microwave rendering could be a good method to render fat with high quality. A study done by Zhang et al. (2011) showed that yields and characteristics of chicken fat from broiler abdominal fat issue were also affected by the microwave power level and irradiation time. Many measurements, such as peroxide value, acid value, 2-thiobarbituric acid (TBA) value, are common to be applied in order to evaluate the quality of fats and oils. Additionally, color of fats and oils is often one of the most important criteria during consumers' selection. Therefore, the aim of this study was to evaluate the effects of rendering methods on the yield and quality characteristics of chicken fat from broiler skin fat.

II. MATERIALS AND METHODS

Broiler skin which obtained from a commercial poultry deboning plant was received frozen and stored at -20°C. Before testing, the skins were thawed at room temperature for 4 h. The rendering was conducted according to the methods of Sheu and Chen (2002) and Zhang et al. (2011) with some modifications. Oven rendering (OR): Samples were heated at 180°C for 40 min in a conventional oven. Water cooking (WC): Samples were boiled with a skin/water ratio (1:2 w/w) for 40 min. Low-power (LM) and high-power (HP) microwave rendering: Samples were rendered at the power level of 2.4 W/g and 3.6 W/g for 12 min respectively using a microwave oven. Rendering yield, acid value, peroxide value, 2-thiobarbituric acid (TBA) value, and color of rendered chicken fat were determined according to the methods of Sheu and Chen (2002) and Zhang et al. (2011). The data were analyzed by the Analysis of Variance procedure (ANOVA) of the Statistical Analysis System software package. Duncan's multiple range test was used to separate the means when significant differences occurred.

III. RESULTS AND DISCUSSION

Figure 1 showed that yield of broiler skin fat from HM and LM (36.6% and 38.4%, respectively) were significantly higher than that from oven rendering (30.4%), and finally WC one (23.2%). These results agree with the report of Sheu and Chen (2002). No significant difference in yield was observed between LM and HM in this study. However, Zhang et al. (2011) observed that the yields of rendered broiler abdominal fat increased significantly as microwave power density increased from 2.0 W/g to 2.75 W/g, whereas no significant different was observed between power density of 2.75 W/g and 3.0 W/g.

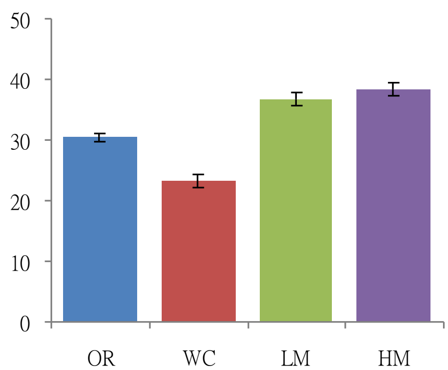
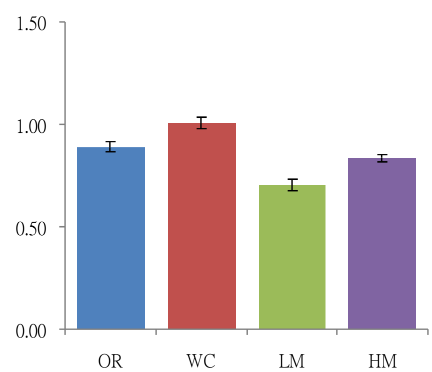
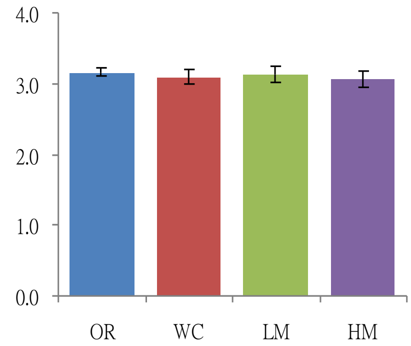


Figure 1. Yield (%) of broiler skin fat as obtained from different rendering methods.

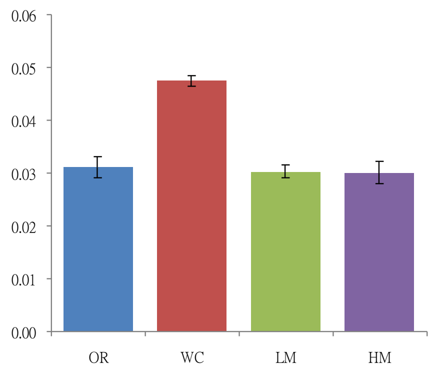
Acid value of broiler skin fat obtained using WC was significantly higher, followed by OR and HM, and finally LM (Fig. 2a). However, no significant difference ($P > 0.05$) was observed between the free fatty acid value for rendered fat among the five methods including microwave rendering, water cooking, conventional oven baking, griddle rendering, and deep-fat frying in a study done by Sheu and Chen (2002). In this study, acid value of chicken fat increased significantly as the microwave power increased. Zhang et al. (2011) found peroxide value of rendered broiler abdominal fat decreased as the power level increased from 2.0 W/g to 2.75 W/g and then increased as the power level increased further to 3.0 W/g. The authors concluded that chicken fat obtained at 2.75 W/g had the lowest TBA value, peroxide value, and acid value. When the power level was stronger than 2.75 W/g, these fat quality indexes increased. No significant difference in peroxide value was detected between the treatments (Fig. 2b). A study done by Sheu and Chen (2002) showed that no significant difference was observed between the skin fat obtained from microwave rendering, conventional oven baking and water cooking. Pereira et al. (1976) reported that peroxide value for dry rendering methods were higher than that of wet rendering methods and it might be due to the temperature and more oxygen incorporation during the rendering process. In this study, peroxide values did not differ significantly between HM and LM. A study done by Zhang et al. (2011) showed that the peroxide values of the chicken fat decreased significantly as the microwave levels increased from 2.0 W/g to 3.0 W/g, whereas no significant difference was observed in the samples between the power levels of 2.75 W/g and 3.0 W/g. Fig 2c showed that WC sample had the significantly higher TBA values ($P < 0.05$), whereas no significant difference was observed between other treatments. TBA values in LM and HM did not significantly differ ($P > 0.05$). A significantly lower TBA value in rendered chicken fat was observed in the sample at power level of 2.75 W/g, whereas the TBA values increased significantly as the power level increased or decreased (Zhang et al. 2011).

(a)





(b)



(c)

Figure 2 (a) acid value (b) peroxide value (meq/kg) and (c) TBA value of broiler skin fat as obtained from different rendering methods.

Table 2 showed the skin fat obtained by using HM and LM had significantly higher L* values which illustrated lighter colors, followed by WC, and OR. Skin fat obtained from WC and OR had significantly higher negative a* values, followed by low power microwave rendering and high power microwave rendering. Significantly higher b* values which illustrated as more yellow in color were observed in the skin fat obtained from HM, followed by LM, WC, and OR. Similar results regarding the instrumental colors of chicken fat obtained using various rendering methods were also reported by Sheu and Chen (2002). In this study, L* values in the samples at the microwave levels between 2.4 and 3.6 W/g did not significantly differ.

Table 2. Instrumental color characteristics of broiler skin fat as obtained from different rendering methods

	OR	WC	LM	HM
L* value	26.50^{b}	27.19^{ab}	27.91^{a}	28.09^{a}
a* value	-4.04^{c}	-4.34^{c}	-2.61^{b}	-1.66^{a}
b* value	11.67^{d}	14.97^{c}	19.02^{b}	23.71^{a}

IV. CONCLUSION

In conclusion, the results showed that either high or low power microwave rendering could produce higher yield of fat which rendered from broiler skin. Significantly higher acid values and TBA values were obtained for the water cooking samples, whereas no significant difference was observed in the peroxide values between treatments. The skin fat obtained by using microwave rendering had significantly higher L* and b* values. Further study which focuses on the composition and sensory evaluation of fats should be addressed.

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