THE EFFECT OF RAW MATERIALS AND PROCESSING CONDITIONS ON THE QUALITY OF HOME-STYLE CHICKEN SOUP

J. Chen*, X.Y. Tang, G.G. Li, L.J. Zhu, Y.F. Dai, and Y.L. Xiong
School of Food Science and Technology, Southern Yangtze University, Wuxi, Jiangsu 214122, China

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Introduction

Chicken soup, also referred to as chicken broth, is a clear liquid product widely used as an ingredient for prepared foods and as a soup stock in Western countries. In China, chicken soup is traditionally a delicacy consumed in average households. Chicken soup is regarded as nutritious and has the ability to stimulate palate thereby enhancing the appetite. However, as the work pace increases rapidly in recent years, less time is now devoted to preparing home-made meals, including chicken soup that requires long-time cooking to produce the unique aroma and taste. Most chicken soups available in the Chinese food market are prepared in large scales, and are sold as concentrated broth cubes or dry granules or powders. Canned or refrigerated commercial chicken broths are also available.

Due to the emphasis on processing efficiency, commercially prepared chicken soups usually lack the distinct flavour characteristics seen in home-made chicken soups which the consumer prefers. Thus, soup manufacturers are seeking information on home-style chicken soup preparation which may be used to help modify commercial processing conditions. To do so, both processing and raw ingredient factors that determine chemical, physical and organoleptic characteristics of chicken soup must be clearly understood (Masood & Chen, 1995). The objective of the present study was to investigate the influence of raw materials (chicken and meat type) and processing conditions (water to meat ratio; simmering time) on the chemical composition and nutrition values of home-style chicken soup.

Materials and Methods

Fresh whole carcasses (<3 h post-mortem) of battery caged chickens (BCC), free range chickens (FRC), or black-boned chickens (BBC), and other raw materials used in this study, were purchased from a local outlet. Cleaned chicken carcasses were placed in soup pots, covered with cold tap water (water to meat ratio 4:1, 6:1, 8:1, 10:1 and 12:1, w/w) and cooked on electromagnetic stoves. When the boiling point was reached, fresh ginger and shallot were added, and the power was reduced to maintain simmering for 0.5, 1, 2, 3, or 5 hours. After cooking, salt and monosodium glutamate (MSG) were added (1.5 g of salt and 0.2 g of MSG per 100 g of water). Clear liquid soups were collected and cooled.

Chicken soups were subjected to proximate analysis. Umami-relevant compounds, including 5'-inosine monophosphate (IMP), 5'-guanosine monophosphate (GMP), and lactic acid (LA), of each soup were also determined. Results were analysed using the Statistical Analysis System (Version 8.2, SAS Institute, Cary, NC, USA). Student t-test was conducted to determine significant differences between the means.

Results and Discussion

The effect of chicken type. The proximate composition of soups is listed in Table 1. There were no significant differences between the three chicken types in ash, reducing sugar and total solid content ($P > 0.05$), but protein content of BCC soup was higher ($P < 0.05$) than FRC soup, and the fat content of BBC soup was lower ($P < 0.05$) than soups made from the other two types of chicken. It has been reported (Anon., 1998) that black-boned chicken (a variant of *Gallus gallus domesticus*) has a very low fat content, consistent with the present finding. Along with its purported medical benefits, the BBC soup was a good source of nutrients. Although there were slight proximate composition differences between the soups, the contents of umani-relevant compounds were not significantly different. Therefore, chicken types had no apparent effect on the savoury taste of soups prepared under the cooking conditions employed. However, this may need to be validated by sensory evaluation.

Table 1. Proximate composition and content of umami substances in soups from 3 different chicken types

	Proximate composition (%,w/w)					Taste-related compound (mg/g)		
	Protein	Fat	Ash	Red. sugar	Total solid	IMP	GMP	LA
BCC	0.33±0.03^{a}	0.76±0.03^{a}	1.57±0.08^{a}	0.05±0.02^{a}	2.66±0.10^{a}	0.12±0.02^{a}	0.003±0.0003^{a}	0.30±0.11^{a}
FRC	0.21±0.05^{b}	0.73±0.05^{a}	1.46±0.07^{a}	0.02±0.01^{a}	2.51±0.27^{a}	0.13±0.01^{a}	0.003±0.0001^{a}	0.28±0.14^{a}
BBC	0.27±0.03^{ab}	0.48±0.01^{b}	1.52±0.13^{a}	0.05±0.02^{a}	2.42±0.41^{a}	0.14±0.03^{a}	0.003±0.0003^{a}	0.30±0.11^{a}

$^{a\text{-}b}$ Means with different letters in the same column differ significantly ($P < 0.05$).

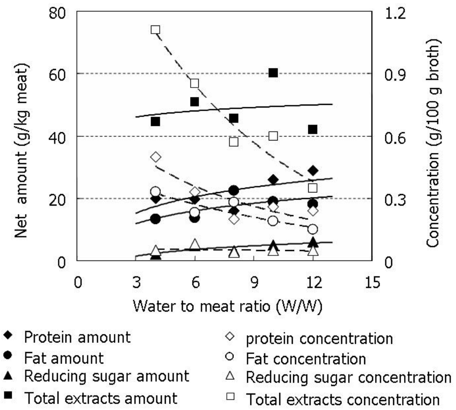

Figure 1. The effect of water to meat ratio on the extraction of nutrients into chicken soup.

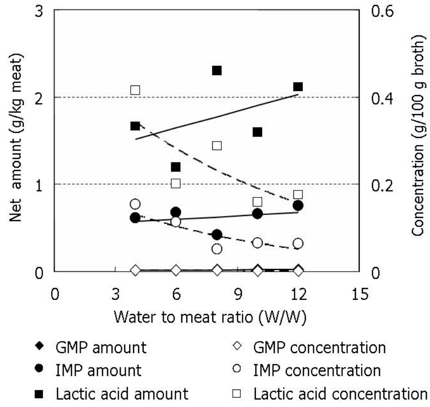

Figure 2. The effect of water to meat ratio on the umami-relevant compounds in chicken soup.

The effect of water to meat ratio. Figure 1 shows the net quantity (g/kg meat) and concentration (g/100 g broth) of main components in chicken soups prepared with different water to meat ratios. The amount of total extracts (less added salt and MSG), protein, fat and reducing sugar in soups increased with increasing the water to meat ratio ($P < 0.05$). The net amounts of IMP, GMP, and LA also increased slightly at higher water to meat ratios (Figure 2). Although the concentration of all constituents except ash in the soup was reduced by raising the water to meat ratio from 4:1 to 12:1 due to apparent dilution, the significantly greater extraction of all nutritional as well as savoury compounds suggested the necessity of using a relatively high water to meat ratio. After all, dilute soups are subsequently concentrated in commercial chicken broth production.

The effect of simmering time. As shown in Figure 3, prolonging the simmering time resulted in an increased nutrient extraction except for the ash content that remained constant due to the fact that salt was added after extraction. Water-soluble components in muscle tissue will leach out, and additional such compounds could be generated during moist cooking (Sasaki et al., 2007). Simmering ostensibly promoted these processes. While lactic acid content in the soups increased dramatically with increasing simmering time (Figure 4), GMP and IMP contents of soups reached a maximum level by 2 hours. Therefore, it is recommendable that simmering be limited to 2 hours to obtain the best savoury taste while maintaining reasonable production efficiency.

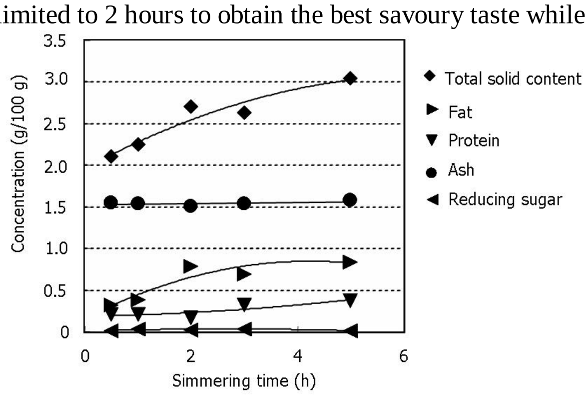

Figure 3. The effect of simmering time on proximate composition of chicken soup.

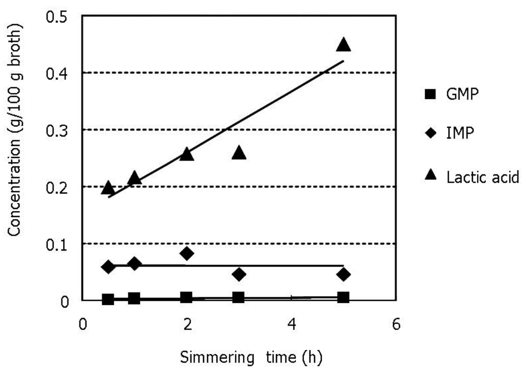

Figure 4. The effect of simmering time on the content of umami-relevant compounds.

Conclusions

The results from this study demonstrated that black-boned chicken is overall the best meat source for preparing low-fat, savoury soup. The total amount of nutrients and main flavour compounds in soup can be increased by using a relatively high water to meat ratio, as well as by controlling the simmering time. To obtain maximum nutrition value, palatability and efficiency, the broth should be simmered for no more than 2 hours.

References

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