PREPARATION AND QUALITIES OF AUTOCLAVED GOOSE BONE BROTH DURING REFRIGERATED STORAGE

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Introduction

In addition to manufacturing as bone meals for animal or aquaculture feeds or as fertilizer (Bureau *et al.*, 2000), bones, which are animal by-products, are also utilized to make broth for human consumption. Broth, also known as soup stock, has been widely applied in cooking to enhance flavors of dishes. Commercial broths are normally made from pig, cattle, chicken or mushrooms (Lin, 1987; Yang, 1996; Weng, 2004; Chiang *et al.*, 2006). Traditionally, broth is made by cooking bone frames in water for a long period of time. Tedious time and energy consumption by using this traditional cooking method makes it is impossible to manufacture broth commercially. Also, such long time cooking at high temperature might also result in more possibilities of fat rancidity, thus reducing qualities of broth. Goose has been raised in Taiwan for years, and its meat is very popular as a special meat source in Taiwan and other areas. Needs of deboned goose to make processed products has been increased largely, thus leads qualities of goose bones produced in volumes. How to utilize this animal byproducts, bone frame after deboning, has been become a big concern for industries in Taiwan. Accordingly, this research was to evaluate the qualities of autoclaved goose bone broth when the products were stored under refrigeration.

Materials and Methods

Goose bone frames in frozen condition were transported to the lab. First, skin, fat, and muscle were trimmed off from bones, washed, drained, categorized into four parts, including back, breast bones, ribs, and leg bones, sealed in bags, and stored at -80°C freezer and ready for further processing. One hundred gram of bones with 300ml distill water were autoclaved at 121°C, 1.2 kg/cm^2 for 3 hrs. After finishing autoclaving, bone residues were sieved out, adding with salt (0.75%, w/w), cooled at room temp for 1 hr, and stored at 4°C for 12 hrs. After sieving the fat floating on the top of the broth, the autoclaved broth was stored at 4°C, and then analyzed at the specific days. Moisture and ash contents were measured according to AOAC method. Crude fat was measured using a fat extractor. Crude protein was measured using the Kjeldahl method. TBA values of the samples were determined according the methods described by Salih *et al.* (1987). Volatile basic nitrogen was determined by the Conway micropipette diffusion method. Autoclaved goose bone broth in flasks were warmed in a 65ºC water bath for 20 min, and then served to the sensory panel. The sensory evaluation conducted using a 1 to 7 scale, with 1 representing the lowest intensity and the lightest color. Data were analyzed using the SAS software.

Results and Discussion

Back and rib bone broths contained significantly higher moisture and lower protein contents, while breast broth contained lower moisture and higher protein contents (Table 1). Leg broth had significantly higher fat content than other parts. This higher fat content in leg broth was probably because of higher bone marrow content in long bones, such as leg bones, thus contributed to higher adipose tissue contents (Hedrick *et al.*, 1994), and then was released in broth during processing. A significantly higher pH value of the leg broth was probably because of higher bone marrow content in leg bones. The leg, breast, and back broths had significantly higher L* values than the rib one. Rib broth had significantly smaller negative a* values which indicated less green color while the breast and leg bone broths had larger negative ones. Breast and leg broths tended to have significant higher b* values than the rib and back bone broths.

Table 1. Proximate composition of autoclaved goose bone broth

Part	Proximate composition				pH	Color evaluation		
	Moisture	Protein	Fat	Ash		L*	a*	b*
Back	96.06^x	2.51^x	0.46^y	0.82^x	7.07^x	19.38^x	-0.80^x	0.53^y
Breast	94.58^y	3.37^w	0.77^x	0.87^w	7.04^y	20.44^w	-1.03^{xy}	1.76^x
Rib	96.83^w	1.83^y	0.27^z	0.77^y	6.98^z	15.80^y	-0.42^w	0.34^y
Leg	94.43^y	3.21^w	1.34^w	0.81^x	7.59^w	20.26^w	-1.18^y	2.07^w

$^{w-z}$ Means within a column that have different superscripts are significantly different ($P < 0.05$).

TBA values of broth samples increased with storage time (Table 2). Leg and breast broths that were with higher crude fat contents tended to have higher TBA values than the back and rib broths during storage. Also, the leg broth, which had the highest fat content, had the highest increase of TBA values especially after refrigerated storage for 28 days. Incorporation of oxygen from air and heme iron from bone marrow during processing might lead these two broths higher incidence of lipid rancidity which was undesirable for consumers (Hedrick *et al.*, 1994). Increase amounts of volatile basic nitrogen (VBN), which is the result of decomposition of protein during storage by microorganisms, can be an index of product freshness. The VBN values increased significantly ($P < 0.05$) with storage time. After 28 days refrigerated storage, the VBN value of back broth was significantly higher than the other ones.

Table 2. Changes in TBA and VBN values of autoclaved goose bone broth during refrigerated storage

Part	Storage time (day)						
	0	3	7	10	14	21	28
				TBA			
Back	0.30^{ex}	0.38^{dx}	0.48^{cy}	0.49^{cy}	0.49^{cy}	0.50^{bz}	0.55^{az}
Breast	0.47^{ew}	0.49^{dw}	0.49^{dx}	0.50^{dx}	0.56^{cx}	0.71^{bx}	0.86^{ax}
Rib	0.34^{fy}	0.35^{efy}	0.36^{ez}	0.38^{dz}	0.48^{cy}	0.58^{by}	0.61^{ay}
Leg	0.36^{dx}	0.39^{dx}	0.62^{cw}	0.62^{cw}	0.62^{cw}	1.10^{bw}	1.66^{aw}
				VBN			
Back	3.92^{dw}	4.76^{dw}	6.44^{cw}	7.56^{cx}	9.10^{bw}	9.24^{bwx}	12.25^{aw}
Breast	3.64^{dw}	4.48^{dw}	5.88^{cw}	7.56^{bx}	7.79^{bw}	9.24^{awx}	10.15^{axy}
Rib	4.06^{fw}	5.04^{ew}	6.44^{dw}	8.68^{bw}	7.70^{cw}	8.68^{bx}	9.80^{ay}
Leg	3.64^{cw}	4.20^{bcw}	4.48^{bcx}	5.60^{by}	9.80^{aw}	10.08^{aw}	10.85^{ax}

$^{a-f}$ Means within a row in the same test that have different superscripts are significantly different ($P < 0.05$).
$^{w-z}$ Means within a column in the same test that have different superscripts are significantly different ($P < 0.05$).

Table 3 illustrates breast and leg broths had significantly higher sensory color scores. No significant differences of sensory off-aroma, flavor, and total acceptability among the groups were observed (Table 3).

Table 3. Sensory evaluation of autoclaved goose bone broth

Part	Color	Aroma	Flavor	Off-aroma	Overall acceptability
Back	4.78^{x}	5.44^{w}	4.00^{w}	1.22^{w}	5.00^{w}
Breast	6.33^{w}	3.67^{wx}	4.22^{w}	1.33^{w}	3.78^{w}
Rib	5.11^{x}	3.22^{x}	3.89^{w}	1.22^{w}	4.00^{w}
Leg	6.67^{w}	3.44^{x}	4.78^{w}	1.22^{w}	4.33^{w}

$^{w-x}$ Means within a column that have different superscripts are significantly different ($P < 0.05$).
The sensory evaluation conducted using a 1 to 7 scale, with 1 representing the lowest intensity and the lightest color.

Conclusions

In conclusion, autoclave could be used to manufacture goose bone broth and increasing the uses of this by-product efficiently.

References

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