EFFECT OF RIPENING TEMPERATURE ON QUALITY CHARACTERISTICS OF CHINESE-STYLE SAUSAGES

Fa-Jui Tan[1,*], Ying-Yu Zeng[1] and Deng-Cheng Liu[2]

[1]Department of Animal Science, National Pingtung University of Science and Technology, Taiwan
[2]Department of Animal Science, National Chunghsing University, Taiwan

Introduction

A Chinese-style sausage is a popular traditional processed meat product in Taiwan and many other areas. Traditionally, after stuffing, it was common to hang sausages outdoors and drying under natural condition with sunshine. Without adding starter cultures, Chinese-style sausages would ferment with microorganisms naturally presented and produce specific flavors and texture for this type of product. However, due to sanitary concerns, possible lacking of good sanitation-control and also increasing numbers of modern meat processing facilities, more and more controls such as controlled temperatures and humidity have been applied to make sausage products. Limit research has been conducted to investigate the effect of keeping this traditional sausage in a ripening condition (12-18ºC, 85% relative humidity) on the quality characteristics. Making quality traditional products with modern facilities is always a major interest for the meat industry.

Objectives

The objective of this study was to evaluate the quality characteristics of Chinese-style sausages made under various ripening conditions.

Methodology

Fresh pork ham was ground through a 10.0 mm plate. Fat was partially thawed in a cooler prior to manually dicing into size of 0.5×0.5×0.5 cm^3. After trimming, raw materials including 80% pork ham and 20% cubed pork back fat, were mixed thoroughly with 7.5% sugar, 3.0% rice wine, 1.4% salt, 1.0% monosodium glutamate, 0.2% sodium sorbate, 0.15% polyphosphate, 0.1% white pepper powder, 0.1% sodium nitrate, and 100ppm sodium nitrite, and then curing at 2±2ºC for 1 day. The meat mixture was then stuffed into natural casing. Raw sausages were linked and dried in a preheaded oven at 50°C for 4hr. Following drying, sausages were randomly assigned into three groups, and stored in an incubator which had three separated chambers individually maintaining at 12, 15, or 18ºC with 85% relative humidity. At days of 0, 5, and 10, samples were analyzed for moisture, water activity, pH, L*, a*, and b*, TPC and mold counts. Three

trials were conducted. Data were analyzed using SAS GLM with a 5% level of significance. Means were separated using Duncan's new multiple range test.

Results & Discussion

It shows that the moisture contents of the sausage samples for the 12ºC ripening group increased significantly after 10 days of ripening, while the 15 and 18ºC ripening group samples remained the same (Table 1). After 10 days of ripening, the water activity of the samples was 0.94, which was close to the report in other studies (Kuo and Chu, 2003; Lin and Lin, 2002). The data show that the pH values of thee group sausage samples significantly decreased with storage time, and agreed with other studies (Kuo and Chu, 2003; Wu, 2003). In this study, there was no significant difference of pH values of the sausages among the three treatments between days 0 and 5. It was observed that the samples ripened at 18°C had significantly lower pH of 5.70 and a higher pH reduction of 1.34 pH unit compared with the other two groups ripened at 12 and 15°C after ripening for 10 days. The possible reason is the higher temperature of the sausages ripened, the more the growth of microorganisms naturally presented in the sausages increased, thus results in a more fermentation, and finally a lower pH of products. The results indicated that L* values of the sausage samples remained stable during ripening (Table 2). No significant difference of L* and b* values of the sausages among three treatments was observed during 10 days of ripening. It was found that the a* values of the sausages decreased with storage time but were without significant difference among the different ripening temperature treatments. Also, it showed that the TPC of the 12ºC group samples increased slightly with storage time but without significant difference, while the samples of 15ºC and 18ºC groups increased significantly after 5 days of ripening. After 10-day ripening, only TPC of the 12ºC samples met a standard set by a local sanitary authority which was $\leq 3\times106$ CFU/g; both 15 and 18ºC samples were considered as unqualified microbiologically based on the same standard. The mold counts of the samples increased with ripening for each treatment, and up to 4.4, 5.4, and 6.1 log CFU/g of mold for ripening at 12, 15, and 18ºC samples respectively at day 10.

Conclusions

Based on the results obtained in this study, Chinese-style sausages should be ripened at 12ºC based on the microbial evaluation in order to obtain products with less total plate counts and mold counts which qualified according to the local sanitary standard and with acceptable qualities.

References

Kuo, C. C., & Chu, C. Y. (2003). Quality characteristics of Chinese sausage made from PSE pork. *Meat Science*, 64, 441–449.

Lin, K. W., & Lin, S. N. (2002). Effects of sodium lactate and trisodium phosphate on the physicochemical properties and shelf life of low-fat Chinese-style sausage. *Meat Science*, 60(2), 147–154.

Wu, S. W. (2003). Effects of various levels of *Monascus purpureus* and 1% *Monascus pilosus* on the quality of low-nitrite Chinese-style sausages during storage at 4ºC. Master thesis. National Chung Hsing University. Taichung, Taiwan.

Tables and Figures

Table 1. Changes in moisture content and water activity of Chinese-style sausages during ripening

Parameter	Ripening temperature (ºC)	Ripening time (day) 0	5	10
Moisture (%)	12	48.40^{b}	50.12^{ab}	51.15^{a}
	15	49.28	50.28	50.49
	18	50.26	50.89	49.97
Water activity	12	0.93^{b}	0.94^{a}	0.94^{a}
	15	0.93^{b}	0.94^{a}	0.94^{a}
	18	0.94^{a}	0.94^{a}	0.94^{a}

^{abc} Means within a row have different superscript are significantly different ($p<0.05$).

Table 2. Changes in pH value of Chinese-style sausages during ripening

Ripening temperature (ºC)	Ripening time (day) 0	5	10
12	6.86^{ax}	6.54^{bx}	6.28^{cx}
15	6.89^{ax}	6.52^{bx}	6.12^{cx}
18	7.04^{ax}	6.56^{bx}	5.70^{cy}

^{abc} Means within a row have different superscript are significantly different ($p<0.05$).
^{xy} Means within a column have different superscript are significantly different ($p<0.05$).

Table 3. Changes in total plate counts and mold counts of Chinese-style sausages during ripening

Items	Ripening temperature (ºC)	Ripening time (day) 0	5	10
Total plate count (CFU/g)	12	4.80^{ax}	5.26^{ax}	5.34^{ax}
	15	4.89^{bx}	5.74^{abx}	6.49^{ay}
	18	4.56^{bx}	6.95^{ay}	6.76^{ay}
Mold counts (CFU/g)	12	3.10^{bx}	3.74^{abx}	4.37^{ax}
	15	3.32^{bx}	4.35^{bx}	5.40^{ay}
	18	3.17^{bx}	5.49^{ay}	6.13^{ay}

^{ab} Means within a row have different superscript are significantly different ($p<0.05$).
^{xy} Means within a column have different superscript are significantly different ($p<0.05$).

Table 4. Changes in color values of Chinese-style sausages during ripening

Ripening temperature (ºC)	Ripening time (day)		
	0	5	10
		L values	
12	37.45	38.50	37.51
15	37.28	39.16	38.22
18	37.14	37.37	38.23
		a values	
12	11.33[a]	8.16[b]	8.71[b]
15	11.06[a]	9.01[b]	8.78[b]
18	11.32[a]	9.18[b]	10.57[ab]
		b values	
12	7.41	7.74	8.93
15	7.46	7.95	8.58
18	7.93	8.06	8.02

[ab] Means within a row have different superscript are significantly different ($p<0.05$).