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EFFECTS OF *MONASCUS PURPUREUS* AND *MONASCUS PILOSUS* ON THE QUALITY OF LOW-NITRITE CHINESE STYLE SAUSAGES

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Introduction

In the orient, *Monascus* is usually used in meat or fish as a preservative or coloring agent to increase flavor. Many researches also indicated that *Monascus* can be used as a starter in fermentative foods such as sake, soy sauce, soy cheese and miso owing to some metabolites as alcohol, ester, organic acids, enzyme, pigment, antihypertension, anti-hycholesteremia, and antimicrobial agent (Wong and Bau, 1977; Yasuda, 1983; Tsuji et al., 1992, Chen and Tseng, 1989). Nitrite is usually used as an ingredient in the curing solution as an antibacterial, coloring and antioxidant. However, a class of carcinogenic compounds known as nitrosamine can be formed in meat products by reactions between nitrite and amines (Judge et al., 1989). A low nitrite meat product with *Monascus*, therefore, is expected for the health concern in this study.

Objectives

The purpose of this study was to understand effects of different levels (0, k1=0.5, k2=1 and k3=1.5%) of *Monascus purpureus* (CCRC No. 31499) and 1% *Monascus pilosus* (CCRC No. 31527) on the quality of low-nitrite Chinese-style sausages during storage at 4° for 56 days.

Methodology

Monascus purpureus (CCRC No. 31499) and Monascus pilosus (CCRC No. 31527) will be incubated as the following procedure was described by Food Industry Research and Development Institute in Taiwan. The Chinese style sausage and curing formula were manufactured according to the description of Tseng (1999). A 100ppm sodium nitrite was used as a commercial control (A) and a only 25 sodium nitrite was used as low nitrite (C). K1 is a low-nitrite sausage with 0.5% Monascus purpureus and 1% Monascus pilosus. K2 is a low-nitrite sausage with 1% Monascus purpureus and 1% Monascus pilosus. K3 is a low-nitrite sausage with 1.5% Monascus purpureus and 1% Monascus pilosus.

The chemical composition, water activity, pH value, TBA value, VBN value, total plate count, mold count, anaerobic bacteria count, and color of the products with vacuum package were to determine at the 0, 7th, 14th, 28th and 56th day during cold storage at 4°.

The sensory panels (color, flavor, texture and overall acceptance) of all cooked sausages were also performed at the 0, 28th and 56th day. A 7 scores hedonic system was used in this experiment to evaluate which one is accepted (score 4). All data were analyzed by SAS system (2002).

Results& Discussion

The results showed that the chemical compositions of low-nitrite Chinese-style sausages were not affected by addition of different levels of *Monascus purpureus* and 1% *Monascus pilosus.* The water activity of all treatments were not significantly different with storage time and the value was from 0.919 to 0.935. A slower decline rate of pH for all treatment of low-nitrite Chinese-style sausages with *Monascus* can be found. Additionally, with addition of *Monascus*, the degrading rate of nitrite can be slowed down in this study. In the aspect of microorganism, the total plate count, mold count and anaerobic bacteria count of Chinese-style sausage with different levels of *Monascus purpureus*(K1:0.5%, K2:1% and K3:1.5%) and 1% *Monascus pilosus* were significantly higher than that of A and C, and the values were from 7.07 to 7.91 log CFU/g , 6.87 to 8.16 log CFU/g and 7.09 to 7.99 log CFU/g, individually, during cold storage (4°).

TBA value of all treatments with different levels of *Monascus purpureus* (K1:0.5%, K2:1% and K3:1.5%) and 1% *Monascus pilosus* were higher than that of the A and C at the 7th day during storage, and TBA value increased with *Monascus* levels. The products with 0.5% *Monascus* and 1% *Monascus pilosus* (K1) had the similar VBN values as the A and C. The a value of all sausages with *Monascus* were higher than that of A and C. Moreover, a value of K1 was almost the same as the C treatment. The L value of A and C were higher than that of all sausages with *Monascus,* therefore darker red color were showed in sausages with *Monascus*. The overall acceptance of Chinesestyle sausage with 0.5% *Monascus purpureus* and 1% *Monascus pilosus*(K1) can be accepted when these products stored at 4 for 28 days.

Conclusions

In conclusion, 0.5% *Monascus purpureus* and 1% *Monascus pilosus*(K1) was an optimal addition for Chinese style sausage owing to it has better sensory results and shelflife also can be extended up to 28 days at 4°.

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Tables and Figures

Table 1. Changes of pH value of Chinese-style sausages with different levels of *Monascus purpureus* and 1% *Monascus pilosus* during cold storage (4°)

Storage	**Treatments**[1]				
(days)	**A**	**C**	**0.5%**	**1%**	**1.5%**
0	**6.40±0.10^{a,x}**	**6.35±0.05^{a,x}**	**6.32±0.04^{a,x}**	**6.32±0.02^{a,x}**	**6.32±0.03^{a,x}**
7	**6.22±0.23^{ab,x}**	**6.23±0.07^{a,x}**	**6.14±0.23^{a,x}**	**6.19±0.13^{a,x}**	**6.34±0.04^{a,x}**
14	**5.77±0.18^{b,x}**	**5.87±0.19^{a,x}**	**5.80±0.29^{a,x}**	**5.81±0.25^{a,x}**	**6.12±0.15^{a,x}**
28	**4.68±0.23^{c,x}**	**4.92±0.12^{b,x}**	**5.10±0.24^{b,x}**	**5.05±0.38^{b,x}**	**4,97±0.23^{b,x}**
56	**4.52±0.13^{c,x}**	**4.66±0.13^{b,x}**	**4.73±0.14^{b,x}**	**4.75±0.14^{b,x}**	**4.75±0.18^{b,x}**

$^{a-c}$ Means within the same column with different superscripts are significantly different ($p<0.05$).

^{x,y} Means within the same row with different superscripts are significantly different ($p<0.05$). A: 100ppm sodium nitrite, C:25 ppm sodium nitrite.

Table 2. The panel scores[1] of the overall acceptance of Chinese-style sausages with addition of various levels of *Monascus purpureus* and 1% *Monascus pilosus* during cold storage (4°)

	Storage time (days)		
Treatments	**0**	**28**	**56**
A	***5.0 ± 1.05^{a,x}**	**3.3 ± 1.15^{bx}**	**3.1 ± 1.37^{a,y}**
C	**5.6 ± 1.26^{a,x}**	**3.4 ± 0.84^{b,y}**	**3.1 ± 0.99^{a,y}**
0.5%	**5.2 ± 0.91^{a}**	**4.5 ± 0.84^{ab}**	**3.6 ± 1.17^{a}**
1%	**5.0 ± 1.05^{a}**	**3.5 ± 0.52^{b}**	**3.6 ± 0.69^{a}**
1.5%	**4.4 ± 0.84^{a}**	**3.0 ± 1.05^{b}**	**3.8 ± 1.60^{a}**

Footnote is the same as Table 1

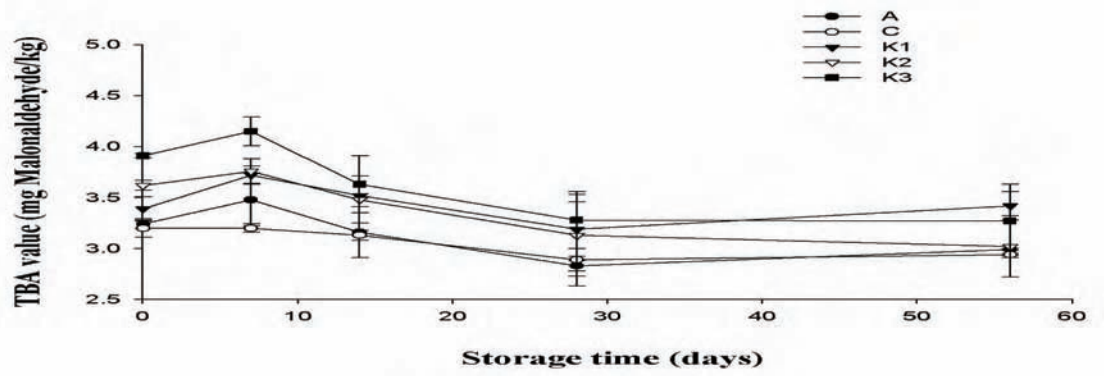

Fig. 1. Changes in TBA value of Chinese-style sausages with different levels of *Monascus purpureus* and 1% *Monascus pilosus* during cold storage (4°).

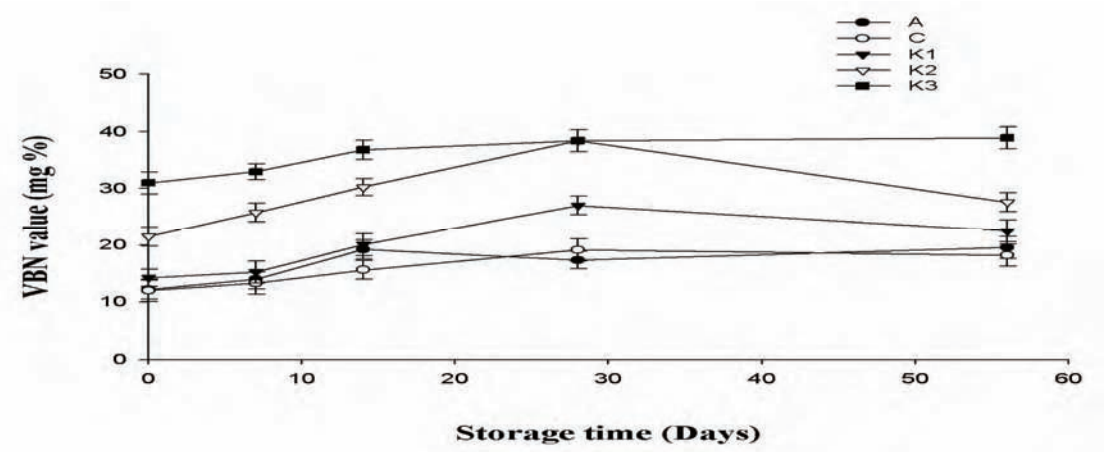

Fig. 2. Changes in VBN value of Chinese-style sausages with different levels of *Monascus purpureus* and 1% *Monascus pilosus* during cold storage (4°).

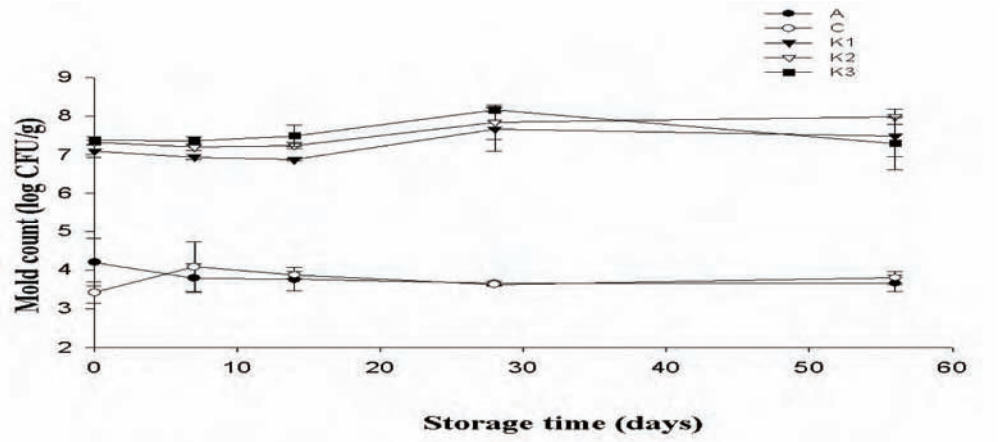

Fig. 3. Changes in mold count of Chinese-style sausages with different levels of *Monascus purpureus* and 1% *Monascus pilosus* during cold storage (4°).