# EFFECT OF ORYZANOL ON LIPID STABILITY, TEXTURE AND SENSORY PROPERTIES OF GROUND PORK PRODUCTS

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**Background**

The oxidation of fat is a major cause of deterioration in the quality of meat and meat products. It can adversely affect many characteristics including flavor, color, texture and nutritive value. Due to the existing restrictions and the continuing safety controversy over the use of synthetic antioxidants such as BHA. BHT or PG, meat processors have searched for natural antioxidants and extracts from natural vegetable sources such as tocopherols and specific spice extracts to reduce fat oxidation and prolong the shelf life of meat products. Rice bran, a by-product of rice milling, contains oils, protein, vitamins, oryzanol and essential minerals. Rice bran oil is more stable under frying conditions than any other common vegetable oil due to a more even balance between lineleic acid and oleic acid, a low level of linoleic acid and a high level of antioxidants (vitamin E vitamers: 0.1-0.14%; oryzanol: 0.9-2.9%) (Sayre and Saunders, 1990). Oryzanol, a mixture of esters of ferulic acid with sterols and trierpene alcohols, has antioxidant properties similar to that of vitamin E (Ishitani, 1990) and is claimed to promote human and animal growth, facilitate blood circulation and stimulate hormonal secretion (Okada and Yamaguchi, 1983).

**Objective**

The objective of this study was to investigate the effects of oryzanol which has been extracted from rice bran, on lipid stability, sensory properties and other quality characteristics in ground pork and pork sausage.

**Materials and Methods**

**Extraction of oryzanol:** The oryzanol was extracted from the rice bran and purified (95%) by Cho et al (2000). The extracted oryzanol were identified by HPLC (Seetharamaiah et al., 1986)

**Antioxidant assay of oryzanol in linoleic acid and ground raw or cooked pork samples:** Linoleic acid containing different concentrations of oryzanol, BHA and BHT were stored at 40℃ for 10days and the antioxidant activity was determined by thiocyanate method(Mistuda et al., 1966). For ground samples, porcine legs and fat trimings of two carcasses were obtained from a local meat processor. Each separated fraction was ground twice through a 0.32-cm plate. The ground lean and fat fractions were divided into 21batches to make three replication of seven treatments. The treatments consisted of 0.02%, 0.05%, 0.10%, 0.20% of oryzanol, 0.02% BHA, 0.02% BHT, and distilled water only for the control. Each treatment was divided into 200-g portion, and cooked to an internal temperature of 80℃ in a 100℃ waterbath. Cooking time for the meat to reach this internal temperature(as monitored by thermocouple) was established in preliminary trials. Test samples were cooked according to this predecided time. The ground pork samples were placed on petri-dish(8cm-diameter, 1.3cm-depth) and stored at 4℃.

**Manufacture of pork sausage and analytical methods:** Pork sausages were manufactured with hind legs of pork. The lean and fat portions were combined to make the final fat contents of 15%. The crude oryzanol were added as 0.05%, 0.1% and 0.2% prior to the addition of the other ingredients and then compared with control, which had no additives. Chemical compositions were analyzed by AOAC(1990). The hardness, springness, cohesiveness and chewiness were determined by Instron Universal Testing Machine(Model 4465). For color determination, the sausage samples were cut into 2cm thickness and measured by Chroma meter(Minolta Co. CR 301) for lightness(L), redness(a), yellowness(b) of CIE. The modified distillation TBA procedure of Rhee(1978) was used to determine the extent of lipid oxidation for sausage products stored at 10℃ for 14days. Sulfanilamide was added to prevent the formation of diazonium salt during the fat extraction step. The absorbance at 530nm was measured by spectrophotometer. The eight members of trained sensory panelists evaluated the samples for juiciness, tenderness and flavor using a 7-point scale(7=very juicy, very tender, very intense; 1=very dry, very tough, very weak).

**Statistical analysis:** Data was analyzed using the SAS program(1990) and means were separated by the Student-Newman-Keuls' test.

**Results and Discussion**

The oryzanol was extracted from rice bran and had higher antioxidant activity in linoleic acid than treatment using synthesized antioxidants such as BHA or BHT as well as the control when they were used at amounts of more than 0.1% (Figure 1). The cooked

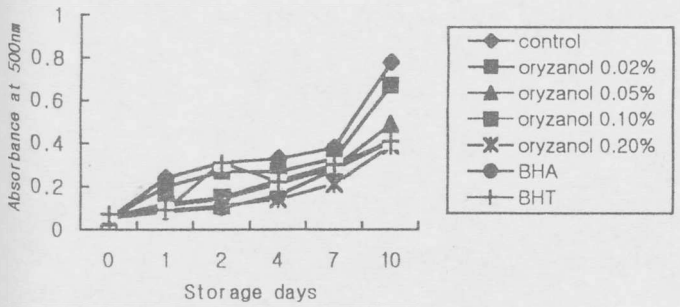


**Fig. 1. Antioxidant activity measured by thiocyanate method when stored at 40℃.**

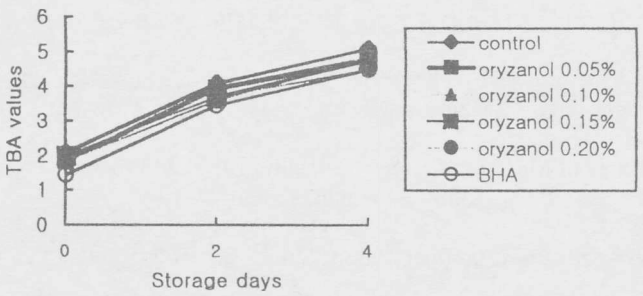


**Fig. 2. TBA values as related to total sample for cooked ground pork with 10% fat when stored at 4℃.**

**Table 1. TBA values, color, texture and sensory properties of pork sausage containing different concentrations of oryzanol**

| | TBA values by storage days | | CIE | | | WBS (kg/cm) | Textural properties* | | | | Sensory attributes** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 14 | L | a | b | | HD | CO | SP | CH | F | J | SP | OP |
| Control | 0.087 | 0.103$^{a}$ | 75.69$^{a}$ | 10.19 | 7.27 | 0.27 | 1.68$^{a}$ | 0.64$^{ab}$ | 4.13$^{a}$ | 1.06$^{a}$ | 4.77 | 4.50$^{ab}$ | 4.27 | 5.14 |
| Oryzanol | | | | | | | | | | | | | | |
| 0.05 | 0.088 | 0.093$^{ab}$ | 75.17$^{ab}$ | 10.43 | 6.90 | 0.28 | 1.52$^{b}$ | 0.67$^{a}$ | 3.33$^{b}$ | 1.02$^{ab}$ | 4.63 | 4.09$^{b}$ | 4.27 | 4.86 |
| 0.10 | 0.089 | 0.092$^{ab}$ | 74.47$^{b}$ | 10.19 | 7.44 | 0.28 | 1.59$^{b}$ | 0.59$^{b}$ | 4.41$^{a}$ | 0.97$^{b}$ | 4.05 | 4.86$^{a}$ | 3.95 | 4.59 |
| 0.20 | 0.088 | 0.088$^{b}$ | 73.75$^{b}$ | 10.67 | 7.28 | 0.26 | 1.51$^{b}$ | 0.67$^{a}$ | 4.17$^{a}$ | 0.98$^{b}$ | 4.22 | 4.54$^{a}$ | 4.46 | 4.82 |

*HD; hardness, CO; Cohesiveness, SP; Springness, CH; Chewiness **F; Flavor, J; Juiciness, S; Springness, OP;Overall palatability

ground pork containing more than 0.10% of oryzanol showed TBA values as low as those containing BHA during storage (Figure 2). Pork sausage containing oryzanol had low TBA values when stored at 4℃ for 14 days (Table 1) and showed low *a* values of CIE in meat color when compared to those of the control. The hardness and chewiness values for the sausage products containing oryzanol were lower than the control when measured by an Instron Universal Testing Machine. However, there were no differences in WBS between the sausage products containing the oryzanol and the control. In sensory evaluation, pork sausage products containing oryzanol and control had no significant difference in flavor, springiness and overall palatability.

## Conclusions

The oryzanol extracted from rice bran provided higher antioxidative activity than the control, which contained no antioxidant, and was as effective as BHA in retarding oxidation of ground pork products when used at rates >0.10%. The products containing oryzanol were acceptable when evaluated based on meat quality factors. Therefore, the oryzanol can be used as a natural antioxidant to replace synthetic antioxidants in meat processing.

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