# GARLIC POWDER PROMOTES LIPID OXIDATION IN FRANKFURTERS

Igor Tomasevic[1], Slavisa Stajic[1], Milica Acimovic[2], Dubravka Skunca[3,*], Vladimir Tomovic[4] and Ilija Djekic[3]

[1] Animal Source Food Technology Department, Faculty of Agriculture, University of Belgrade, 11080 Belgrade, Serbia

[2]University of Novi Sad, Institute of Food Technology, 21000 Novi Sad, Serbia

[3]Food Safety & Quality Management Department, Faculty of Agriculture, University of Belgrade, 11080 Belgrade, Serbia

[4]University of Novi Sad, Faculty of Technology, 21000 Novi Sad, Serbia

[*]Corresponding author email: dubravkaskunca@hotmail.com

**Abstract – Three different frankfurters were made: control without spice, with garlic powder (*Allium sativum L.*) conventionally produced and with organic garlic powder. The experiment investigated the effect of added garlic on the lipid oxidation of vacuum packed frankfurters during their shelf life. Both types of frankfurters, with conventional and organic garlic powder, exhibited significantly higher concentration of malondialdehyde after 35 days of cold storage, compared to control samples. Significant difference in lipid oxidation between frankfurters with conventional and organic garlic could not be observed.**

**Key Words – garlic, TBARS, shelf life.**

## I. INTRODUCTION

Garlic (*Allium sativum*) is one of the most commonly used ingredients as a flavour enhancer in meat products. The flavour of frankfurters is typically due to black pepper, nutmeg and possibly coriander and garlic [1]. One of the modes of action of spice and herb antioxidants is as free radical scavengers, by blocking free radicals through donation of hydrogen atom. A major cause of meat product deterioration is oxidative rancidity. Oxidation of lipids in meat and meat products is responsible for changes in its nutritional quality, loss of vitamins and essential amino acids, colour, flavour, odour and texture. Spices and herbs have been known to contain bioactive compounds that can prevent oxidation of oils and fats. From a technological standpoint, the use of garlic and their derivatives in meat and meat products has been proposed by many authors due to their antioxidant activity [2,3]. The so-called 'secondary metabolites' make a major contribution to the specific odours, tastes and colours of (spices) plants [4]. There is ample, but circumstantial, evidence that, on average, organic vegetables most likely contain more of these compounds than conventional ones [5]. Hence, the present study aimed to evaluate the possible differences in lipid oxidation of frankfurters made without or with addition of organic and conventionally grown garlic.

## II. MATERIALS AND METHODS

### Frankfurter samples preparation

As raw material, post-rigor pork (mixture of round and shoulder muscles) and fresh back fat were purchased from a major local retailer. The meat was trimmed of visible fat and connective tissue. Frankfurters were manufactured in a pilot meat processing plant of the Faculty of Agriculture, University of Belgrade.

Five different batters, first without (control) and four with (single) spice, were produced all containing 50% of pork meat, 25% of back fat and 25% of water (ice). This was performed in duplicate using meat batters of 4 kg. All batters were produced on the same day and in identical manner: refrigerated meat and fat were chopped to 8 mm particle size in a meat grinder (Laska 82H, Austria) and then mixed with ice, nitrite-salt (1.8%), polyphosphate (0.4%), soy protein isolate (1%), sodium erythorbate (0.04%) and sugar (0.5%) in a meat cutter (Müller EMS, Germany) until the temperature reached 7°C. Finally, 3% of the single selected type of spice was added to the mixture and the comminution process was

continued while ensuring that the maximum batter temperature did not exceed 12°C. Two different types of garlic powder (*Allium sativum L.*) were used: conventionally produced (GC) and from organic origin (GO). Both types of garlic were obtained from the same producer (Lay Gewürze, Germany) declaring their accordance with organic Regulation (EC) No 834/2007 where appropriate.
After emulsification, prepared batter was stuffed into 24 mm diameter collagen casings, after which they were hanged, smoked and cooked for approximately 2 hours in a smoking/cooking chamber (Belje, Croatia), until the temperature in the central part of the sausages reached 72°C/10 min. The cooked sausages were showered in cold water and stored at 4 ± 1°C for a period of 35 days.

**Lipid oxidation (TBARS) measurement**

Malondialdehyde (MDA), the compound used as an index of lipid peroxidation, was determined by a selective third-order derivative spectrophotometric method according to Botsoglou *et al.* [6] with slight modifications. In brief, 2 grams of samples with 10 ml of 5% aqueous solution of trichloroacetic acid (Merck, Darmstadt, Germany) and 5 ml of 0.8% butylated hydroxytoluene (Sigma Chemical Co, St. Louis, MO) in hexane, were briefly vortexed (CZ Classic, Velp Scientifica, Italy) and then homogenized in ultra-sonic bathroom (ATM40-3LCD, Madrid, Spain) for 5 min before being centrifuged (Eppendorf Centrifuge 5804 R, Hamburg, Germany) at 3,000 rpm for 5 minutes. The top layer was discarded, and a 2.5-ml aliquot from the bottom layer was mixed with 1.5 ml of 0.8% aqueous 2-thiobarbituric acid (Sigma Chemical Co, St. Louis, MO) to be further incubated at 70°C for 30 min in water bath (Memmert MB14, Germany). Following incubation, the mixture was cooled under tap water and submitted to conventional spectrophotometry (Shimadzu, Model UV-160A, Tokyo, Japan) in the range of 400-650 nm. The concentration of MDA in analysed samples was calculated as described by Botsoglou *et al.* [6]. Results are expressed as mg MDA/kg frankfurter.

## III. RESULTS AND DISCUSSION

The antioxidative activity of garlic aroma (sulphur) compounds (allicin, diallyl disulfide, and diallyl trisulfide) was previously confirmed [7]. However, when it comes to antioxidative activity of garlic powder in meat and meat products, limited data is available. Park *et al.* [8] examined the antioxidant effects of garlic powders (5%) in fresh pork belly and pork loin. Samples were vacuum-packaged and held at 8°C for 28 days. The authors found that garlic powders were effective at reducing TBARS values in fresh pork belly, but no significant reduction was found in the pork loin treated with garlic powder.
Our results suggest that garlic powder, both conventional and organic, promoted lipid oxidation in frankfurters throughout the complete period of their shelf life. The MDA concentrations were significantly higher ($p < 0.5$) in samples with added garlic compared to control (Tab. 1).

Table 1 The effect of garlic powder on lipid oxidation (mg MDA/Kg) of frankfurters during shelf life

| | Days of cold storage | | | | |
|---|---|---|---|---|---|
| Frankfurter | 1st day | 7th day | 14th day | 21st day | 35th day |
| Control | 0.28[a] (±0.07) | 0.31[a] (±0.01) | 0.35[a] (±0.08) | 0.47[a] (±0.11) | 0.52[a] (±0.07) |
| Garlic conventional | 0.47[b] (±0.01) | 0.50[b] (±0.06) | 0.56[b] (±0.06) | 0.61[b] (±0.05) | 0.78[b] (±0.08) |
| Garlic organic | 0.59[b] (±0.01) | 0.62[b] (±0.06) | 0.65[b] (±0.07) | 0.68[b] (±0.05) | 0.71[b] (±0.01) |

[a,b]Means ± standard deviation within a same day lacking a common superscript letter are significantly different ($P < 0.05$).

Our results are in agreement with the findings of Mariutti *et al.* [9] suggesting that garlic presented no effect as antioxidant and accelerated lipid oxidation in chicken meat.
Significant difference in lipid oxidation between frankfurters with conventional and organic garlic could not be observed during the period of 35 days of cold storage (Tab. 1).

## IV. CONCLUSION

Meat product producers should take into account that garlic powder could promote lipid oxidation in frankfurters. This study revealed that garlic powder could promote rancidity in cooked

comminuted meat products during their shelf life. The difference of conventional or organic garlic powder had no effects on oxidative status of frankfurters. Whether higher concentrations of malondialdehyde in frankfurters with garlic powder significantly affected their color, texture or taste should be a subject of future research.

REFERENCES


1. Knipe, C. L. (2014). Types of sausages. In C. Devine, Encyclopedia of Meat Sciences (Second Edition) (p. 256-260). Academic Press: Oxford.
2. Bhattacharyya, D. (2011). A comparative study on the antioxidant and antimicrobial properties of garlic and coriander on chicken sausage. International Journal of Meat Science. 1(2): 108-116.
3. Sallam, K., Ishioroshi M. & Samejima K. (2004). Antioxidant and antimicrobial effects of garlic in chicken sausage. Lebensmittel-Wissenschaft Technologie. 37(8): 849-855.
4. Bennett, R. N. & Wallsgrove R. M. (1994). Secondary metabolites in plant defence mechanisms. New Phytologist. 127(4): 617-633.
5. Brandt, K. & Mølgaard J. P. (2001). Organic agriculture: does it enhance or reduce the nutritional value of plant foods? Journal of the Science of Food and Agriculture. 81(9): 924-931.
6. Botsoglou N. A., Fletouris D. J., Papageorgiou G.E., Vassilopoulos V. N., Mantis A. J. & Trakatellis A. G. (1994). Rapid, Sensitive, and Specific Thiobarbituric Acid Method for Measuring Lipid Peroxidation in Animal Tissue, Food, and Feedstuff Samples. Journal of Agricultural and Food Chemistry. 42(9): 1931-1937.
7. Kim, S. M., Kubota K. & Kobayashi A. (1997). Antioxidative Activity of Sulfur-containing Flavor Compounds in Garlic. Bioscience, Biotechnology, and Biochemistry. 61(9): 1482-1485.
8. Park, S. Y., Shim, J.H., Chin, K. B. (2008). Physicochemical properties, and antioxidant and antimicrobial effects of garlic and onion powder in fresh pork belly and loin during refrigerated storage. Journal of Food Science. 73(8): 577-584.
9. Mariutti, L. R., Nogueira, G. C. & Bragagnolo, N. (2011). Lipid and cholesterol oxidation in chicken meat are inhibited by sage but not by garlic. Journal of Food Science. 76(6): 909-915.