## The Effects of Using Arugula Extract or pre-converted Arugula Extract as Nitrite Source in Heat Treated Fermented Sausages

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**Introduction:** Processed meats are the source of nitrite in our diet because the meat industry uses nitrate/nitrite as an additive in the meat curing process (Karwowska and Kononiuk, 2020). The incorporation of nitrate or bioconverted nitrate (nitrite) from natural sources is a highly relevant solution to reduce the health risk of nitrite (Sebranek and Bacus, 2007; Hwang et al., 2018). Arugula species may contain 4800-6400 ppm nitrate (EFSA, 2008). Therefore, this study aimed to investigate the application of arugula extract (AE) or pre-converted arugula extract (PAE) as nitrite sources in heat-treated fermented sausages, evaluate their effect on the residual nitrite and color pigments.

**Materials and methods:** Nitrate or pre-converted nitrite from arugula extracts were prepared methods stated by Chou et al. (2003) and Kim et al. (2019). Production of heat-treated fermented sausages (HTFS) was carried out according to Zungur et al. (2015). The HTFS without nitrite and formulated with 150 ppm NaNO2 served as control groups (negative control, CNS, and positive control (CPS). 150 ppm nitrite and nitrate from PAE and AE added to the HTFS was named as PAS and AS. Chemical composition parameters were determined by AOAC (2012) and Flynn and Bramblett (1975). The color characteristic of HTFS samples was measured with a portable color measurement instrument (Konica Minolta CR-200). Residual nitrite content of HTFS after production determined according to AOAC (2012). The content of nitrosomyoglobin and total pigments were identified with a method maintained by Hornsey (1956). Conversion ratio was calculated from the nitrosomyoglobin concentration divided by the total pigment concentration.

**Results:** Moisture, fat, protein, and ash contents of HTFS were ranged between 47.43-49.53%, 18.52-24.45%, 22.44-27.42%, and 3.66-4.11% respectively. The L* and a* values of the internal surface of HTFS were not affected by the treatments. CPS and all reformulated groups had similar b* values higher than CNS ($p<0.05$). The lowest external L* and highest external a* values were found in CPS groups ($p<0.05$). Sausage with a higher residual nitrite level showed a higher a* value. A drastic change was recorded when nitrite is replaced by PAE or AE. CPS had the highest residual nitrite content as expected and no statistical differences were found in between CNS, AS, or PAS. Kim et al. (2018) reported lower residual nitrite content in the meat cured with fermented spinach than control counterparts that added sodium nitrite.

The highest and the lowest nitrosomyoglobin amounts were found in the CPS and CNS respectively. It has been determined that the amount of total pigment in HTFS varied between 109.36 and 155.93 ppm. The bio-conversion process has a significant effect on the total pigment amount ($p <0.05$), thus the addition of PAE increased the total pigment amount. CPS had the highest conversion rate, followed by PAS.

**Conclusions:** In this study, it was shown that residual nitrite content of heat-treated sausages could be reduced and regarding nitrosomyoglobin and total pigments, the use of arugula extract as a nitrite source was found insufficient due to the short processing time. In a conclusion, using pre-converted arugula extract had a promising potential to use in heat-treated fermented sausage production as a nitrite source.

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