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Effect of vegetable powders as nitrite sources on the quality characteristics of cooked sausages (#388)

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Introduction

For centuries nitrate and nitrite have been used extensively in preserving meat products. Nitrate and, more specifically, nitrite, create the distinctive cured meat characteristics (Zhang et al., 2014). A primary function of nitrite is the production of the characteristic pink color of cured meats, which is desired by the consumer and is usually indicative of quality of cooked products, nitrite also inhibits lipid oxidation and contributes to desirable meat product flavor (Sebranek and Bacus, 2007). In addition the most important role of nitrite is its antimicrobial activity, specifically against controlling the growth of Clostridium botulinum. Despite all of its desired properties, the safety of nitrite to human health has been questioned. Nitrite can cause the formation of carcinogenic Nnitrosamines in cured products due to its reaction with secondary amines and amino acids in muscle proteins. Residual nitrite in cured meats may form N-nitrosamines in the gastrointestinal tract Thus; the meat industry continues to search for alternative methods to produce nitrite-free meats that maintain the color characteristics of nitrite cured meat products (Riel et al., 2017). Regarding the potential health concerns of nitrite, consumers prefer natural additives instead of synthetic additives in meat products due to the health risks involved. Therefore, the replacement of chemical additive nitrite with natural additives have increased in recent years (Riel et al., 2017). Some Vegetables with high content of nitrate such as carrot, celery, spinach, red beet and parsley in the form of powder or extracts, qualify as nitrate sources (Riel et al, 2017; Ko et al., 2017). Celery (Apium graveolens var. graveolens) products like juice concentrate and powder are the main widely used additives as nitrate sources in studies related to cured meat products (Sindelar et al., 2007). Parsley (Petroselinum crispum) extract powder is often used in spice mixtures. Due to its high nitrate content it is an innovative alternative for the direct addition of nitrite in the production of meat products. Spinach (Spinacia oleracea L) has often been seen as a major vegetable source for nitrate in the human diet According to Walker (1990), nitrate level in spinach is as high as 2,470 ppm. Red Beet (Beta Vulgaris), is regarded as a rich source of nitrate and it contains bioactive phytochemicals, including phenolic compounds which functions as antioxidant and natural colorant components in meat products (Sucu &Turp, 2018). Nitrate in this vegetables must be reduced to nitrite by microorganisms such as Staphylococus xylosus and/or Staphylococus carnosus (Sebranek and Bacus, 2007). The objective of this study was to evaluate the possibility of replacing sodium nitrite with vegetable powders of (celery, spinach, parsley and red beet), as a nitrite alternatives in the production of cooked sausage by examining the changes in some quality characteristics during 28 days of storage period at 4 °C.

Methods

1- Production of vegetable powders
2- Production of cooked beef sausage
3- Proximate composition analysis
4- pH determination
5- Residual nitrite analysis
6- Color measurement
7- Thiobarbituric acid value (TBARS)
8- Lactic acid bacteria

Results

Due to the potential health risk associated with nitrites, nitrite alternatives from vegetable sources in meat products have been investigated. Therefore, in this study cooked sausages, manufactured with 0.438 % celery powder, 0.425 % parsley powder, 0.29 % red beet powder and 0.404 % spinach powder were produced. These sausage samples were compared to a traditionally nitrite-cured control. The inclusion of red beet powder increased a* value of samples and resulted in the protection of the desired red color during storage. There were significant differences among samples treated with vegetable powders and the sausage with sodium nitrite (control) at the end of storage period. The lactic acid bacteria count was higher in samples treated with vegetable powders. After 4 weeks of storage, no significant difference in TBARS value was observed between the sausages with sodium nitrite (control) and the sausages with red beet and spinach powder.

Conclusion

This work showed that replacing nitrite by vegetable powders is an effective strategy to develop new meat products. At the same time, lower residual nitrite levels could be achieved with the use of vegetable powders and marketing of these products may consequently reduce consumers' intake of nitrite. Redness value (a*) of the samples increased and was well protected during the storage when an increased amount of beetroot powder was used. No significant difference in TBARS value was observed between the sausages with sodium nitrite (control) and the sausages with red beet and spinach powder at the end of storage. After 4 weeks of storage, the control sample (sausage with sodium nitrite) had significantly more residual nitrite than the sausages treated with vegetable powders. The lowest LAB count ($p<0.05$) during stor

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age period was observed in the control sample. The traditional meat products with no/reducedsynthetic nitrite will be a new opportunity for consumers.

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