RESEARCH ARTICLE

ASSESSMENT OF SAUSAGES RESIDUAL NITRITE IN KERMANSHAH PROVINCE

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ABSTRACT

Meat and its products are considered as valuable source of protein in human nutrition. Nitrite compounds commonly used in meat products in order to create the desired color, flavor and good taste, preventing spore growth of *Clostridium botulinum* and increasing storage time, but the complications resulting from their applications shall be followed standard rules. The aim of the new study was determine the amount of residual nitrite in3 strong consumer brands of sausage (Hot Dog, German and Cocktail Wieners) in Kermanshah province and compliance with the standards for permissible levels have been performed. A total of 81 samples of sausages collected and evaluated amount of residual nitrite with spectrophotometry method. Results demonstrated that the amount of residual nitrite in 7/41 percent of the products were more than standard concentration, but most of their products than allowed lower. The amount of nitrite in 4 day and in November was most. Also, this study showed that the remaining nitrite in all meat products that stored at 4°C is reduced in 10 and 20 days, so reduced quality of sausage over time after production.

INTRODUCTION

Meat is animal brawn that is consumed as food by human and animal. Meat is consist of 75 percent water, 19 percent protein, 2.5 percent intramuscular fat, 1.2 percent carbohydrates and 2.3 percent other soluble non-protein substances. These include amino acids (nitrogenous compounds) and minerals (inorganic substances). Above reason caused that many of people use meat and meat products every day[1]. Meat products are processed products, resulting from the processing of meat or from the extra processing of such processed products, so that the cut surface indicates that the product no longer has the characteristics of recent meat[2].

One of this meat products is sausage. Sausage is a cylindrical meat product usually made from ground meat, often beef, or veal and pork. Sausage is considered a valuable protein source in human nutrition and protein materials that have been necessary and need amino acids to provide for consumers with several tastes. So, the role of the meat industries is more to its use daily. It is essential to provide the health, quantity and quality of products, quality control of industrial products should be done more earnest and with the perfect amplitude[3].

When sausage is industrially processed in procurement of expenditure, it may be fortified with additives to protect or modify its color or flavor, to improve its juiciness, tenderness or cohesiveness, or to aid with its preservation. Sausage additives includenitrite, salt, phosphates, erythorbate, sweeteners, seasonings impart, flavorings, tenderizers, antimicrobials components, acidifiers, and antioxidant constituents[4, 5]. Nitrite as a sausage additive in form of sodium nitriteis used in curing meat to stabilize the meat's flavor and color, and prevents the growth of spore-forming Clostridium botulinum[6-8]. But excessive use of residual nitrite is dangerous. Nitrites can combine with amines, products of protein segregation in meats, to form nitrosamines (During curing meat with nitrite, nitrosamine amounts enhance in comparison with raw meat without adding additives), potentially harmful substances. Cancers most commonly associated with nitrosamines include nasopharynx, esophageal, stomach, colorectal, bladder, prostate, andnon-Hodgkins lymphoma cancers. Central nervous system, thyroid, heart, and kidney cancers have also been yielded in animal studies. Also, in vivo studies, nitrosamines have caused birth defects as well as enhanced pregnancy loss[9-12]. Thus, it is necessary to control

levels of residual nitrite in several brands of sausages as a meat product.

Based on knowledge of authors, there is a very little data about amount of residual nitrite in sausages (Hot Dog, German and Cocktail Wieners) are distributed in Kermanshah province, in west of Iran. Hence, the aim of the recent study was investigate residual nitrite levels sausages in comparison with standard and its changes over time in them in Kermanshah in 2012(November) and 2013 (January and February).

MATERIALS AND METHODS

Sausage samples collection

In this type of cross-sectional analysis to determine the amount of residual nitrite in sausage distributed, Kermanshah, first in the sausage's factories in this province 81 samples were taken (3 strong consumer brands (Hot Dog, German and Cocktail Wieners), each brand is 27samples on three dates (4, 10 and 20 days before reaching to the consumers).

Evaluation of residual nitrite level in Sausage samples

200 grams of sample were sampled in according to 690 national standard of Iran. The sample was mixed uniformly. 10 g was weighed with almost a thousandth of a gram. AOAC method was applied for measuring residual nitrite on photometry method (diazotization method) with 538 nm wavelength. The sample transferred to a Mayer flask 200 ml for the deposition of proteins and then were surcharged100 ml of distilled water and 5 ml of saturated borax solution with the lower temperature of 70 °C. After cooling, 2 ml of zinc acetate reagent and 2 ml of potassium cyanide reagent were added in it. After mixed each addition, the contents of the flask were reached to a volume of 200 ml in flask. After 30 minutes for obtaining a clear solution, supernatant was removed by folded filter paper. For the color, 25 ml of filtrate transferred to 100 ml volumetric flask and was added 60 ml of distilled water in it. Then 6 ml of hydrochloric acid solution and 10 ml of sulfonyl amine solution were added and thoroughly mixed. After 5 minutes, 2 ml of Alpha - Nftyl solution were added in 25 °C temperature in the dark. After 3-10 min, its volume brought to 100 ml in the dark. Light absorption was computed with spectrophotometer (model T80) at a wavelength of 538nm. A standard curve was developed using several concentrations of nitrite (Merck, German, 99% NaNO2)[13].

Statistical analysis

Descriptive statistics including the mean, minimum, maximum, median, and standard error were computed for all changeable. The one-way ANOVA followed by Turkey post hoc test were used for measurement of various parameters. The data were analyzed by SPSS software, version 22.0 and $P<0.05$ was avowed as statistically significant.

RESULTS AND DISCUSSION

Meat products such as sausage now is a main part of daily diet, and also is considered as one of the alternative protein sources[2]. In sausage, sodium nitrite is a usually used additive in processed meat products which is applied for some goals such as leaving a suitable taste, stabilizing color, and increasing antioxidant and antimicrobial effects particularly, against infectious bacteria such as clostridiums[6, 7]. World Health Organization and Food and Agriculture Organization determined an acceptable daily intake of 0.07 mg/Kg of human body weight for sodium nitrite[9].The acceptable maximum

amount for sodium nitrite in processed meat products is 120 ppm in Iran[13].

In this study, concentration of residual nitrite has been 120/89, 111 and 100/22 (November 2012), 118/33, 108/22 and 94/33 (January 2013) and 120/56, 109/67 and 98 (February 2013) in 81 samples of sausages were studied on 4, 10 and 20 days after producing (sodium nitrite mg per kg) respectively. 6 samples (7/41%) had residual nitrite higher than the accepted national standard and 75 samples (92/59%) had residual nitrite at the standard. The results of residual nitrite concentration in the sausages samples and compare it with the standards are in figure 1 and tables 1-2.

Table 1 Light absorbance of nitrite in standard concentrations.

Light absorbance (λ_m)	Nitrite concentration (molar)
0/0	0/0
0/043	2/5
0/086	5/0
0/170	10/0
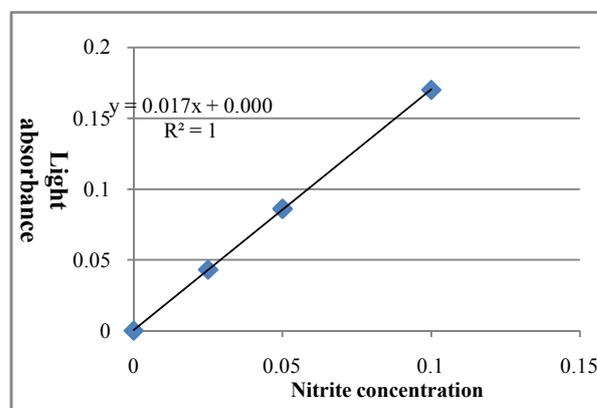
Figure 1 calibration curve of nitrite concentration

Table 2 Distribution of relative frequency in sausage product on the amount of residual nitrite and compare it with the standard.

The amount of residual nitrite	Frequency	Percentage
Permissible range	75	92/59
Higher than Permissible range	6	7/41
Total	81	100

Table 3 Comparison of nitrite concentration average changes in sausage in 4, 10 and 20 days.

Month	4 day	10 day	20 day
November	120/89	111	100/22
January	118/33	108/22	94/33
February	120/56	109/67	98/00

The results demonstrate that nitrite is more than the standard in some samples. It Conform to the results of Yarmohammadi *et al* in Esfahan. In Yarmohammadi *et al* study was identified that concentration residual nitrite was higher than the standard in some cases and lower than the standard in other cases and the amount of sodium nitrite had highly significant difference with the standard amount in salami andsausage[14]. In other study in Semnan, the amount of residual nitrite was higher than permissible range in some cases of sausages types[15]. In similar study, indicated significant difference between the residual nitrite in a Cocktail Wieners sausage, dry and liuner salami to compare with German sausage and Liuner salami,

also demonstrated that concentration residual nitrite in above meat products was higher than the standard in some cases[16]. ANOVA results showed that the average of residual nitrite concentration in sausage samples at 3 time (4, 10, 20 days) after intake was statistically significant (P <0.001), so that amount of residual nitrite in 4 day is more than 10 and 20 days, and level of residual nitrite in November is more than January and February. The results of this study on nitrite concentration changes in sausages, has been a decreasing over time. In a study showed that amount of residual nitrite reduced during maintenance time that agree to the results of our study[17]. In other study assessed levels of residual nitrite in 60 days, the results of this study demonstrated that amount of residual nitrite decreased every day[7]. In general in this study, the amount of residual nitrite was variable between 70- 140 in the sausages that were tested. In total, the amount of residual nitrite in 7/41 percent of the products were more than standard concentration.

CONCLUSION

The results show that nitrite concentration is decreased over time, recommend that the appropriate maintenance conditions observe for these products and it is best that they are at least used before 10 day from production time. Also, this study shows that the amount of nitrite is more than permissible range in west of Iran (In Kermanshah) and considering this fact that nitrites and nitrosamine can be effective to prevalence and incidence cancer in humans and animals.

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