



## Sensory and Microbiological Quality of Pork Sandwich Spread Enriched with Honey, Vitamin-C and Nisin

Shivesh S. Sengar<sup>1\*</sup>, Ramesh C. Keshri<sup>1</sup> and Pradeep K. Singh<sup>2</sup>

<sup>1</sup>Division of Livestock Production and Technology, I.V.R.I., Bareilly, INDIA

<sup>2</sup>Division of Livestock Production and Technology, College of Veterinary Science & A.H., Rewa, M.P., INDIA

\*Corresponding author: SS Sengar; Email: shivesh\_ivri@rediffmail.com

Received: 28 July, 2016

Accepted: 30 December, 2016

### ABSTRACT

Pork sandwich spread incorporated with functional ingredients like honey, vitamin-C and nisin was stored at refrigeration temperature and studied for its shelf life, acceptable in terms of the sensory and microbiological parameters. A highly significant ( $P < 0.01$ ) difference for the appearance, texture, spreadability and adhesionability scores were found significant decrease ( $P < 0.05$ ) for Juiciness and overall acceptability scores was recorded while there was an increased level for the flavor score were even on the 30<sup>th</sup> day of storage of pork sandwich spread. The remarkable acceptability for the pork sandwich spread was given by the panelists even on 30<sup>th</sup> day of storage. Total Plate Count (TPC) and Psychrophilic count on 30<sup>th</sup> day of storage were found to be 2.92 log cfu/g and 2.21 log cfu/g respectively. The Coliform, Yeast and Mould were not detected throughout the experimental period in the treated sample and it was found safe for consumption.

**Keywords:** TPC, psychrophilic, Nisin, citric acid, sandwich

Storage of meat often leads to the development of abnormal odors, tastes and loss of colour. The chemical composition and biological characteristics make meat an excellent environment for microbial growth. In tropical countries like India, there is a preferential need for such a method of preservation that can help in further enhancement of shelf life and quality. Pandey (2006) had standardized the different parameters of the pork sandwich spread but short shelf life, water and fat separation and rancidity were among the common problems being faced in the meat spread. So, there is a need of a methodology, for the preservation of meat spread which enhances the quality and storage capacity at refrigerated temperature. Hence in the present study the product was incorporated with certain ingredients (honey, vitamin-C and nisin) having functional properties to improve the product quality and storage stability. The honey treatment appeared to reduce bacterial growth in the product (Anon, 1998). Nisin is a bacteriocin produced by the lactic acid bacterium *Lactococcus lactis* (formerly *Streptococcus lactis*). Bacteriocin has additional advantages; they are degraded by proteolytic enzymes in

the gastrointestinal enzymes and also non toxic (Guerrero *et al.*, 1995). Citric acid is also known to confer protection against product deterioration, the pH of a product is shifted to being more acidic, where very few moulds, yeast and bacteria are able to grow and multiply. Citric acid is preferred over any other acid simply because it is safe for human consumption. Citric acid also helps to protect the flavour and increases the effectiveness of antioxidants. Hence the functionality of the above ingredients is assessed in the pork sandwich spread.

### MATERIALS AND METHODS

Meat samples were obtained from pigs (live weight between 60-70 kg) slaughtered in the experimental abattoir of Livestock Products Technology Division (IVRI, Izatnagar). After removal of all separable connective tissue and fat, meat was trimmed off and stored in colourless polythene bags for overnight at  $4 \pm 1^\circ\text{C}$  for conditioning and then frozen at  $-18 \pm 1^\circ\text{C}$  for further use. Lean meat in the form of small cubes was minced in the meat mincer. Pre

weighed refined oil, spices (Pati, 1990), condiments i.e. onion, garlic and ginger (3:2:1), common salt (0.5%) and black salt (1%) were browned in a pan, then minced meat was added to it and braised for 30 minutes at  $84 \pm 2^\circ\text{C}$ . The pressure cooking method was opted for the preparation of the product and after cooling, the antioxidants (0.02%) and carrageenan (0.20%), skimmed milk powder (2.5%), rusk (2%) along with molten butter (15%) was added to the product. A pre weighed mixture of sugar (0.25%) sodium nitrate and nitrite (0.02%) citric acid (0.20%) sodium tripolyphosphate (0.40%) sodium ascorbate (0.10%) and glycerol (2%) and ice (1.81%) was added to it. Thorough mixing of the ingredients with the minced meat was done to obtain the homogeneity. The product was grinded in the mixer grinder at 500-1200 rpm for 1-2 minutes to get the paste of desired consistency, mean while the colouring agent was also added (at the rate of 0.20gm /15ml/1kg batch).

The product was transferred in a glass tray and stored for further experiments. Honey (6%) level, Vitamin-C at the rate of 500 ppm and nisin at the rate of 12 mg/kg level was added and carried for the sensory and microbiological parameters on refrigerated storage. Plastic pet jars with lid of 200 g capacity were used for storage studies. Experienced taste panel members consisting of scientist and post-graduate students of the Division and the Institute evaluated the sensory attributes viz. appearance and colour, flavour, juiciness, texture, adhesion ability, spreadability and overall acceptability of treatments and control using 7 point descriptive hedonic scale (Baker and Scott- Kline, 1988; Keeton, 1983). Total plate count, psychrotrophic count, coliform count, and yeast and mold counts in the samples were determined following

the methods as described by APHA (1984). Data were analyzed statistically on a Window XP computer in the Computer Centre of the Institute using Statistical Software Packages developed by following the procedure of Snedecor and Cochran (1989).

## RESULTS AND DISCUSSION

A highly significant ( $P = 0.01$ ) difference for the appearance, texture, spreadability and adhesionability scores were found, a significant decrease ( $P = 0.05$ ) for the juiciness and overall acceptability scores were recorded while there was an increased level for the flavor score were recorded on the 30<sup>th</sup> day of storage of pork sandwich spread. (Table 1).

Results of ANOVA revealed that there was a highly significant ( $P = 0.01$ ) variation in the appearance and color which might be due to lipid and muscle pigment oxidation leading to non enzymatic browning of the product (Pandey, 2006). Spreadability and adhesionability scores were found to be highly significant ( $P = 0.01$ ) which might be due to the loss of moisture during refrigeration storage of pork sandwich spread. A significant decrease ( $P = 0.05$ ) for the juiciness and overall acceptability scores of the pork sandwich spread was also recorded during refrigerated storage certainly due to decrease in other sensory attributes like colour, spreadability and adhesionability. Although, the score was in decreasing trend on 30<sup>th</sup> day even though the scale of score was rated between 'good' to 'very good'. The value of Total Plate Count (TPC) revealed significant ( $P = 0.01$ ) increase on the last day of the experiment that was found to be 2.92 log cfu/g. The quantitative estimation of Psychrotrophs was detected from 20<sup>th</sup> day onwards. The

**Table 1: Effect of Storage on Sensory Parameters of Pork Sandwich Spread at Refrigeration Storage ( $4 \pm 1^\circ\text{C}$ )**

|                              | <b>0 Day</b>     | <b>10<sup>th</sup> Day</b> | <b>20<sup>th</sup> Day</b> | <b>30<sup>th</sup> Day</b> |
|------------------------------|------------------|----------------------------|----------------------------|----------------------------|
| Appearance/Colour            | 7.00±0.00        | 6.97±0.01                  | 6.71±0.05                  | 6.75±0.04**                |
| Flavour                      | 6.88±0.03        | 6.84±0.04                  | 6.92±0.04                  | 6.91±0.03                  |
| Juiciness                    | 6.86±0.05        | 6.86±0.03                  | 6.72±0.04                  | 6.66±0.06*                 |
| Texture                      | 6.96±0.02        | 6.81±0.05                  | 6.57±0.05                  | 6.86±0.05**                |
| Spreadability                | 6.97±0.02        | 7.00±0.00                  | 6.75±0.04                  | 6.60±0.06**                |
| Adhesion ability             | 6.98±0.01        | 6.90±0.05                  | 6.86±0.03                  | 6.45±0.07**                |
| <b>Overall acceptability</b> | <b>6.86±0.05</b> | <b>6.86±0.03</b>           | <b>6.72±0.04</b>           | <b>6.66±0.06*</b>          |

\*Significant ( $P < 0.05$ ) \*\*Highly significant ( $P < 0.01$ )

**Table 2: Effect of storage on Microbiological Parameters of Pork Sandwich Spread at Refrigeration Storage ( $4 \pm 1$  °C)**

| Microbiological parameters       | Days of storage |                      |                      |                      |
|----------------------------------|-----------------|----------------------|----------------------|----------------------|
|                                  | 0 Day           | 10 <sup>th</sup> Day | 20 <sup>th</sup> Day | 30 <sup>th</sup> Day |
| Total plate count ( log cfu/g)   | 2.33±0.007      | 2.43±0.003           | 2.73±0.01            | 2.92±0.02**          |
| Psychrophilic count ( log cfu/g) | Not detected    | Not detected         | 1.64±0.01            | 2.21±0.01**          |
| Coliform count                   | Not detected    | Not detected         | Not detected         | Not detected         |
| Yeast and Mould count            | Not detected    | Not detected         | Not detected         | Not detected         |

\*\*Highly significant ( $P < 0.01$ )

value on 30<sup>th</sup> day was recorded as 2.21 log cfu/g which was quite lower than the permissible limit (Table 2). The Coliform, Yeast and Mould were not detected throughout the experimental period in the treated sample. There was an increased level for the flavor score upto 30<sup>th</sup> day of storage of pork sandwich spread. The value of TPC and psychrotrophs were found to be 2.92 log cfu/g and 2.21 log cfu/g on 30<sup>th</sup> day respectively, slightly increased within its permissible limit during whole experimental period at refrigerated storage. The same finding was observed by Deenathayalan in beef sausages (1997), Pandey (2006) in pork sandwich spread and Lee *et al.* (1997) in chicken sausage. The microbiological count of 5.33 log cfu/g and 4.6 log cfu/g for TPC and Psychrotrophs respectively is considered to be unacceptable in cooked meat products (Jeremiah *et al.*, 1971 and Cremer *et al.*, 1977). Addition of citric acid and nisin with 2% common salt reduced the pH of the meat (Pawar *et al.*, 2000). It was evident from the increased inhibition of *L. monocytogenes* which was responsible for increased TPC. Coliform, Yeast and Mould were not detected in the pork sandwich spread throughout the storage period due to citric acid, sufficient heat treatment (pressure cooking, 122 °C ) and/or due to hygienic measures followed during product preparation. The pork sandwich spread was found safe for human consumption up to 30 days of storage at refrigerated ( $4 \pm 1$  °C) temperature.

## REFERENCES

- Anon 1998. Science News. **154 (11)**: Sept. 12, pp. 170.
- APHA 1984. Compendium of Methods for the Microbiological Examination of Foods. 2nd ed. (M.L. Speck). *Am. Pub. Health Assoc.*, Washington, DC.
- Baker, R.C. and Scott-Kline, D. 1988. Development of high protein coating using egg albumen. *Poult. Sci.*, **67**: 557-564.
- Cremer, M.L. and Chipley, J.R. 1977. Satellite food service system. Time and temperature and microbiological and sensory quality of pre-cooked hamburger patties. *J. Food Prot.*, **40**: 603-607.
- Deenathayalan, P. 1997. Effect of whey protein concentrates, sodium caseinate and skim milk powder on the quality of buffalo meat smoked sausages. M.V.Sc. thesis, IVRI, Izatnagar, India.
- Guerrero, T., Mandiolea, E.P. and Prado, A. 1995. Inoculation of lactic acid bacteria on meat surfaces as a mean of decontamination in semitropical conditions. *Meat Sci.*, **40**: 397- 411.
- Jeremiah, L.E., Reagan, J.O., Smith, G.C. and Carpenter, Z.L. 1971. Ovine yield grades I. Retain case-life. *J. Anim. Sci.*, **33**: 759-764.
- Keeton, J.T. 1983. Effect of fat and NaCl/phosphate levels on the chemical and sensory properties of pork patties. *J. Food Sci.*, **48**: 878-881.
- Lee, S.K., Mei, L. and Decker, E.A. 1997. Influence of sodium chloride on antioxidant enzyme activity and lipid oxidation in frozen ground pork. *Meat Sci.*, **46**(4): 349-355.
- Pandey, A. 2006. Studies on processing of pork sandwich spread. M.V.Sc. thesis submitted to Deemed University, IVRI, Izatnagar.
- Pati, 1990. Effect of method of buffalo fat incorporation on the quality of buffalo meat patties. M.V.Sc. thesis submitted to IVRI Deemed University, Izatnagar.
- Pawar, D.D., Malik, S.V.S., Bhilegaonkar, K.N. and Barbuddhe S.B. 2000. Effect of Nisin and its combination with sodium chloride on the survival of *Listeria monocytogenes* added to raw buffalo meat mince. *Meat Sci.*, **56**: 215- 219.
- Snedecor, G.W. and Cochran, W.G. 1989. *Statistical Methods*. 8th edn, Iowa State University Press, Ames, Iowa.

