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Microbial Storage Stability of Paneer Spread Incorporated with Ginger and Garlic

Jyoti Kumari[1], Basant Bais[2], Pankaj Kanwar[3], Kishan Tosawada[4]

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ABSTRACT

Background: Paneer spread is a perishable item and requires innovative technologies to extend its shelf life. The use of spices to improve sensory and storage life is traditionally used. The milk products and byproducts may be contaminated intentionally/ unintentionally at different level at the time of production, processing and storage. Therefore, the present study was aimed to estimate the microbial analysis of ginger and garlic incorporated paneer spread prepared from cow milk.

Methods: The control and treatment paneer spread samples were examined for the standard plate count (SPC), coliform count, yeast and mould count during storage for 12 days at refrigeration temperature for interval of 0, 3, 6, 9 and 12 days.

Result: The microbial load of standard plate count, increased significantly high (P<0.01) in all the samples whereas the initial yeast and mould count was nil up to 6th day of storage, After that, only a few colonies were seen on the 9th day, which was significantly lower than the prescribed standard, but then increased significantly high (P<0.01). No coliform counts were observed during storage. Therefore, it is concluded that the ginger and garlic incorporated paneer spread were microbiologically safe upto 9th days of storage period. After nine days of storage, it should not be recommended for consumption due to visible yeast and mould growth.

Key words: Coliform count, Mould count microbial load, Standard plate count, Yeast.

INTRODUCTION

The cow milk is a nutritious food because of low calorie, low cholesterol and high micro-nutrients and vitamins. It is high in moisture, carotene, thiamine, riboflavin, sodium and potassium, but low in protein, energy, calcium, phosphorus, fat and cholesterol. Therefore, cow milk is considered as healthy and has a bio-protective effect in human health, immunity, vision, obesity, natural anti-oxidants, nutrient absorption, diabetes, anaemia, increase microbial wealth and anticancer properties (Joshi *et al.,* 2021). Due to the ever growing demand of paneer among various health conscious consumers, researchers were encouraged to develop new styles and varieties of paneer includes skim milk paneer, low-fat paneer, soy paneer, protein-enriched filled paneer, paneer spreads, spiced paneer, masala paneer, fruit paneer and processed paneer (Deshmukh *et al.,* 2009). Spices used in food preparation not only enhanced the taste and flavour but also act as antimicrobial, antioxidants, food stabilizing properties and medicinal properties (Ismail *et al.,* 2006).

Ginger is an important spice and has many uses in flavouring and medicinal properties in food. Ginger has carminative, diaphoretic, spasmolytic and intestinal stimulant properties. Fresh ginger has been used for cold, asthma, nausea, cough, swelling and rheumatism. Antibacterial, antiulcer, antiallergenic and antioxidant properties are also found in ginger extracts. Ginger is a spice with distinct flavour due to a combination of zingerone, shogaols and gingerols, as well as volatile oils (Olaniran and Abiose, 2018). The most abundant pungent component of ginger is 6-gingerol and is claimed to contain antioxidant activity (Baliga *et al.,* 2011).

[1]Department of Livestock Products Technology, College of Veterinary and Animal Science, Rajasthan University of Veterinary and Animal Sciences, Bikaner-334 001, Rajasthan, India.

Corresponding Author: Jyoti Kumari, Department of Livestock Products Technology, College of Veterinary and Animal Science, Rajasthan University of Veterinary and Animal Sciences, Bikaner-334 001, Rajasthan, India. Email: jyotikumari471994@gmail.com

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Garlic is used in food not only for its flavour, but also for its antimicrobial properties. Garlic is used as a preservative in many foods due to its antioxidant and functional properties. It reduces the risk of various diseases like diabetes, cardiovascular diseases and cancer. Its antimicrobial activity is primarily due to thiosulphinate. Allicin is the active principle in garlic which has antibacterial, antifungal, antiviral as well as antiparasitic properties (Ankri and Mirelman, 1999). Allicin is a characteristic sulphur containing compound found in raw garlic produced from alliin and exhibits antimicrobial activity against both Gram positive and Gram negative bacteria (Nakamoto *et al.,* 2020).

Looking at the health benefits of ginger and garlic, the aim of study was to produce paneer spread that are nutritious with different proportions of ginger and garlic were developed with microbiologically safe manner.

MATERIALS AND METHODS

The experiment was designed and conducted in Department of Livestock Products Technology, College of Veterinary and Animal Sciences Bikaner in 2021. Fresh indigenous cow milk (Rathi cow milk) was collected from local indigenous cattle dairy farm, Bikaner. Ginger, garlic, black pepper powder and salt were purchased from local market. The author has already reported method of preparation of paneer spread developed from indigenous cow milk and its sensory quality (Kumari *et al.,* 2021). The prepared paneer spread was filled in pre sterilized glass containers with air tight screw caps and stored at refrigeration temperature (4±1°C).

Various levels of ginger, garlic and ginger+garlic incorporated in cow milk paneer spread, it was found that the inclusion of 2% ginger, 2% garlic and 1% ginger+1% garlic were most suitable for preparation of treatment paneer spread under study.

T_0: Cow milk paneer spread without inclusion of any spices.
T_1: Cow milk paneer spread with inclusion of ginger paste (2%).
T_2: Cow milk paneer spread with inclusion of garlic paste (2%).
T_3: Cow milk paneer spread with inclusion of ginger paste + garlic paste (1%+1%).

Microbial analysis of developed paneer spread

All samples were assessed for microbial status, *i.e*. Standard plate counts, coliform count and yeast and mould count as per standard procedures.

Standard plate count

The standard plate counts of paneer spread samples were evaluated by using method described in IS: 5402 (1969).

Coliform counts

The coliform counts of paneer spread samples were evaluated by using method described by Houghtby *et al.* (1992).

Yeast and mould count

The yeast and mould count of paneer spread samples were determined by using method described in IS: 5403 (1969).

Statistical analysis

All the experiments of study were repeated three times and samples were drawn in duplicate. Data collected during the present investigation were subjected to statistical analysis by adopting appropriate methods of analysis of variance as described by Snedecor and Cochran (1994). Wherever, the variance ratio was found significant at 5 per cent and highly significant at 1 per cent levels of probability, the significance of mean differences was tested by Duncan's new multiple range test (Duncan's range test) as modified by Kramer (1957).

RESULTS AND DISCUSSION

Microbial analysis of prepared paneer spread

Most of the physico-chemical changes like acidity development, change in pH *etc*. are affected by the presence and growth of various microorganisms. Therefore the stored samples of paneer spread were subjected to microbiological analysis for standard plate count (SPC), yeast and mould count (YMC) and coliform count. The changes observed in microbial quality of the paneer spread, prepared with or without incorporation of spices during assessment at a regular interval of 3 days under refrigerated storage condition for 0, 3rd, 6th, 9th and 12th days. No coliform counts were observed during this storage duration.

Standard plate count (SPC) of paneer spread

Moisture content in paneer spread favours the growth of micro-organism. The major spoilage of paneer spread is due to the growth of microbes. Hence, the SPC of paneer spread samples were studied. The graphical representation of standard plate count (SPC) of spices incorporated paneer spread depicted in Fig 1.

The minimum SPC was observed at day 0 for sample T_0, T_1, T_2 and T_3 *i.e*. 5.98±0.026 log (cfu/ml), 5.78±0.025 log (cfu/ml), 5.71±0.024 log (cfu/ml) and 5.73±0.015 log (cfu/ml), respectively but it was found maximum at day 12 *i.e*. 6.42±0.027 log (cfu/ml), 6.39±0.017 log (cfu/ml), 6.31±0.042 log (cfu/ml) and 6.39±0.025 log (cfu/ml), respectively for sample T_0, T_1, T_2 and T_3. During storage of paneer spread at refrigerated temperature, a highly significant (<0.01) increase in SPC up to 12th day was observed and there after the product was found unacceptable due to visible mould growth.

The recorded results are in concord with the findings of Dwivedi *et al.* (2010) in paneer spread, Raj (2013) in chhana spread, Sharma and Jaseja (2016) in paneer spread, Yadav and Wadehra (2016) in paneer, Kumar (2017) in cow milk paneer, Kaur (2019) for paneer spread, Prajapat (2019) in paneer, Wanjari *et al.* (2019) in garlic treated paneer, Singh *et al.* (2020) in khoa burfi and Devi *et al*. (2021) in milk nuggets who reported that the similar trend of significant increase (P<0.01) in the standard plate count with increase of storage period. The findings of study are in contradiction with Tak *et al.* (2018) in yoghurt who observed the significant decrease (P<0.01) in the standard plate count with increase of storage period.

The data related to analysis of variance revealed that a highly significant (P<0.01) increase was observed between period, between treatment and interaction between treatment and period in the standard plate count of paneer spread of the all four sample on the 3rd, 6th, 9th and 12th day of refrigerated storage.

Coliform count of paneer spread

The growth of coliform count shows unhygienic production of the paneer spread. Hence, the coliform counts of paneer spread samples were studied. The product was found to be free from coliform count and during storage period 0th, 3rd, 6th, 9th and 12th day of refrigerated storage there was no coliform count observed. Similar studies were conducted to evaluate the coliform count and no coliform was reported by other workers *viz*. Sharma (2004) in low fat paneer

spread, Dwivedi *et al.* (2010) in paneer spread, Mishra (2013) in paneer, Raj (2013) in chhana spread, Kaur (2019) in paneer spread, Singh *et al.* (2020) in khoa burfi.

Yeast and mould count of paneer spread

The paneer spread possessing high moisture content and having acidic in nature, which favours condition for the growth of yeast and mould on the surface of paneer spread. It is the main cause of spoilage of paneer spread and limiting shelf life of paneer spread. Hence, yeast and mould counts were studied.

The graphical representation of yeast and mould count of all the paneer spread samples depicted in Fig 2. The yeast and mould count of paneer spread samples were found nil up to 6th day of storage. Thereafter, very few colonies were observed on 9th day. The prescribed limit for yeast and mould count is 250 cfu/g (IS:5403-1969). The results showed that samples contained much lower counts than the prescribed standard up to 9th day. So, it can be concluded that the samples were microbiologically safe up to 9th day during storage, after that it was microbiologically unsafe. During further storage of paneer spread an increase in yeast and mould count was observed up to 12th day and thereafter the product was found unacceptable due to visible mould growth. The mean yeast and mould count at day 9 of T_0 was 5.35 ± 0.027 log (cfu/ml) whereas in sample T_1 it was 5.33± 0.017 log (cfu/ml), in sample T_2 it was 5.28±0.035 log (cfu/g) and in sample T_3 it was 5.29±0.016 log (cfu/ml). The mean yeast and mould count of paneer spread of T_0 (control), T_1, T_2 and T_3 for day 12 were 5.48±0.015 log (cfu/g), 5.46±0.024 log (cfu/g), 5.41±0.014 log (cfu/g) and 5.44±0.012 log (cfu/g), respectively.

The statistical analysis revealed that a highly significant difference ($P<0.01$) between treatment, between period and interaction between treatment and period. The results are in agreement with Raj (2013) in chhana spread, Yadav and Wadehra (2016) in paneer, Kumar (2017) in cow milk paneer, Kaur (2019) in paneer spread, Wanjari *et al.* (2019) in garlic treated paneer, Prajapat (2019) in paneer, Singh *et al.* (2020) in khoa burfi and Devi *et al.* (2021) in milk nuggets who reported increase in yeast and mould count during storage.

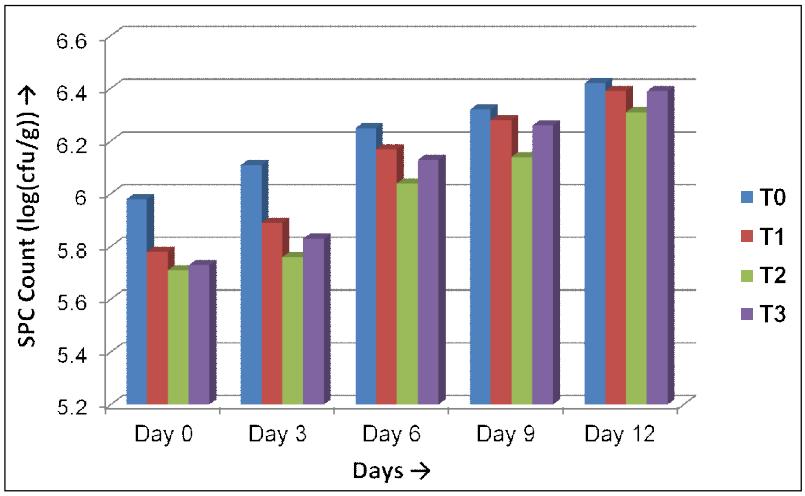

Fig 1: Standard plate count of paneer spread.

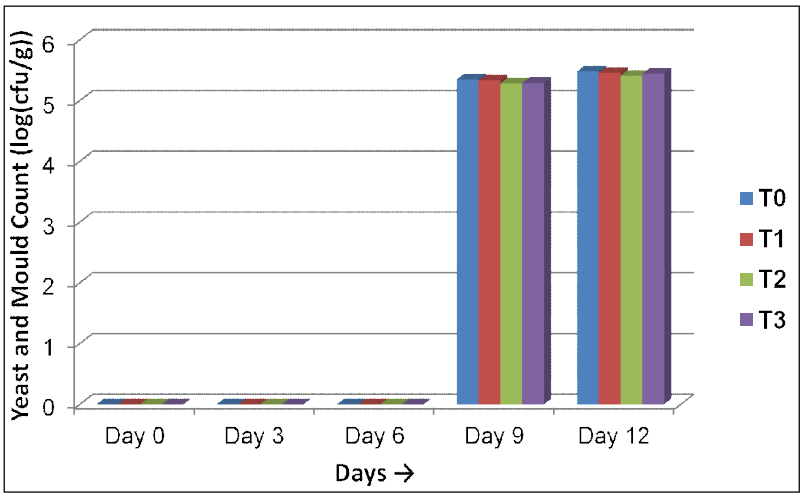

Fig 2: Yeast and mould count of paneer spread.

CONCLUSION

From present study, it may be concluded that the ginger and garlic incorporated paneer spread prepared from cow milk were hygienic and microbiologically safe to consume in fresh condition till 9th days of storage period under refrigeration conditions and consumption of spices as an adjunct or confectionary in milk based products will positively benefit the consumers. Understanding the effects of locally available spices, particularly ginger and garlic, on the microbial properties as well as on consumer acceptability, is essential in improving traditional fermented milk products.

Conflict of interest

All authors declare that they have no conflict of interest.

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