



ISSN (E): 2277-7695  
ISSN (P): 2349-8242  
NAAS Rating: 5.23  
TPI 2022; SP-11(7): 4136-4139  
© 2022 TPI  
[www.thepharmajournal.com](http://www.thepharmajournal.com)  
Received: 19-04-2022  
Accepted: 22-05-2022

**Diwakar Mishra**  
Ph.D. Scholar, Dairy Technology  
Section, ICAR-NDRI (SRS),  
Bengaluru, Karnataka, India

**Jayaraj Rao**  
Principal Scientist, Dairy  
Technology Section, ICAR-  
NDRI (SRS), Bengaluru,  
Karnataka, India

## Effect of ajwain extract on sensory attributes and shelf life of paneer

**Diwakar Mishra and Jayaraj Rao**

### Abstract

Paneer is a tempting, nutritious and delicious acid- heat coagulated indigenous dairy product. Due to high moisture content (about 55%), it has shelf life of only one day at room temperature and up to a week at refrigeration temperature. Hurdles like spices, smoking, packaging etc. can be used to enhance shelf life of paneer. Ajwain is an important spice widely used in the world. Ajwain extract @ of 0.4, 0.5, 0.6 and 0.7% by weight of milk, was incorporated into milk from which paneer was prepared. Paneer was prepared using the milk as per standardised method. It was observed that paneer incorporated with ajwain extract @ 0.6% was acceptable and selected for further analysis. Colour, body and texture and overall acceptability scores of treated sample were lower than of control. While flavour scores of treated paneer were higher than those of control. Shelf life of control and ajwain paneer were only one day at ambient temperature. While shelf life of control and ajwain paneer were 8 and 12 days at refrigeration temperature, respectively. It was found that ajwain improved flavour and increase shelf life of paneer a refrigeration temperature.

**Keywords:** Paneer, ajwain, shelf life, sensory, storage study

### Introduction

Paneer is an important, acid-coagulated indigenous milk product extensively used as a cooking ingredient along with vegetables. Because of its high moisture content (about 55%), paneer has a shelf life of not more than one day at room temperature and up to a week at refrigeration temperature (Bhattacharya *et al.*, 1971) <sup>[2]</sup>. Hurdles like humectants, spices, microwave, smoking, packaging etc. can be used to enhance shelf life of paneer. Spices have been well known for their medicinal, preservative and antioxidant properties (Souza *et al.*, 2005) <sup>[14]</sup>. They are currently used mainly for enhancing the flavor of foods rather than extending shelf life (Almeida and Regitano, 2000) <sup>[1]</sup>. In addition to imparting flavor, certain spices prolong the shelf life of foods due to their bacteriostatic or bactericidal activity, and some prevent rancidity by their antioxidant activity (Shelef *et al.*, 1984) <sup>[13]</sup>. Spices in general show antimicrobial activity due to phenolic component (Deans *et al.*, 1995) <sup>[4]</sup>. The ability of phenolics to interfere with cellular metabolism through a number of mechanisms (substrate complexing, membrane disruption, enzyme inactivation and metal chelation) is well known (Cowan *et al.*, 1999) <sup>[3]</sup>. Present study was conducted to investigate the effect of Ajwain extract on sensory attributes and shelf life of paneer.

### Materials and Methods

#### Preparation of paneer

Paneer was prepared by a standardized method (Bhattacharya *et al.*, 1971) <sup>[2]</sup>. Fresh toned milk was procured from Experimental Dairy Plant of Southern Regional Station of ICAR- National Dairy Research Institute, Bengaluru. Milk was heated to 90 °C without holding and cooled to 80 °C and was coagulated with by adding 1 percent citric acid (2 g/litre of milk) solution at 80 °C. Acid was slowly added to the milk with continuous slow stirring until the curd and clear slightly yellow-greenish whey separated out. The mixture was then allowed to settle down for 5 minutes and whey was drained out through using muslin cloth. Pressing of curd was done with the weight of 35-40 g/cm<sup>2</sup> for 15-20 minutes into muslin cloth lined perforated wooden cubical hoop. Finally, prepared paneer sample was kept in cold water at 5-7 °C for 2 hours. The chilled paneer removed from water and placed on a wooden plank for 10-15 min to drain occluded water and cut into 1cm cubes for further studies.

**Corresponding Author**  
**Diwakar Mishra**  
Ph.D. Scholar, Dairy Technology  
Section, ICAR-NDRI (SRS),  
Bengaluru, Karnataka, India

### Spice extract preparation

Required quantity of ground ajwain (@0.4, 0.5, 0.6 and 0.7% by weight of milk) was weighed and taken into a beaker. Water (about 3 times weight of spice) was added to the spice and kept at room temperature for 12 hours. This soaked spice was again ground in a grinder and filtered through muslin cloth. This filtrate was added to milk during boiling of milk.

### Ajwain paneer preparation

In the preparation of spice paneer, same procedure was followed as given above.

### Sensory evaluation

Nine-point Hedonic scale method (Lawless and Heymann, 2010) [9] was used for sensory evaluation of all the samples by a panel of 7 semi trained judges. The samples were coded to preserve the identity of the samples presented to the judges. The samples were evaluated for color and appearance, body and texture, flavor and overall acceptability on the Hedonic scale ranging from 1 to 9 and the preferences were recorded in the sensory performa provided to the panelists.

### Shelf life

Paneer was packed in packaging material (polystyrene cups), stored at ambient temperature (30±1 °C) and refrigeration temperature (7±1 °C). Samples were taken out at regular interval for evaluating sensory and microbial analysis.

### Analytical methods

SPC and yeast-mold counts of the paneer were estimated as per the method of ISI (1981a) [7].

### Statistical analysis

Data of sensory analysis obtained in the study were subjected to statistical analysis by one way ANOVA using MS-Excel package version 2007. The differences among treatments were measured at 5% level of significance.

### Result and discussion

#### Effect of Ajwain extract on sensory quality of paneer

Ajwain extract was incorporated into paneer at the rate of 0.4, 0.5, 0.6 and 0.7% by weight of milk. The ajwain incorporated paneer was then subjected to sensory evaluation by judges. After sensory analysis, it was found that paneer incorporated with ajwain at 0.6% got maximum flavor score (Table-1), which was significantly different from control. However, use of 0.7% ajwain gave harsh taste, resulting in lower flavor score. Thus, 0.6% ajwain incorporated paneer was chosen for further studies.

Color and appearance scores of ajwain paneer were significantly lower ( $p \leq 0.05$ ) than control paneer due to reduction in whiteness of paneer. It may be due to color imparted by ajwain. On incorporation of 0.6% ajwain, color and appearance score decreased ( $p \leq 0.05$ ) to 7.20 as compare to 7.90 for control (Table-1).

**Table 1:** Effect of incorporation of ajwain extract on sensory score of paneer

Ajwain treatment	Color and appearance	Body and texture	Flavor	Overall acceptability
Control paneer	7.90±0.10 <sup>a</sup>	7.81±0.17 <sup>a</sup>	7.58±0.12 <sup>a</sup>	7.93±0.05 <sup>a</sup>
0.4%	7.58±0.12 <sup>ab</sup>	7.61±0.12 <sup>ab</sup>	7.60±0.10 <sup>a</sup>	7.71±0.07 <sup>ab</sup>
0.5%	7.45±0.08 <sup>bc</sup>	7.51±0.13 <sup>ab</sup>	7.68±0.16 <sup>a</sup>	7.61±0.15 <sup>ab</sup>
0.6%	7.20±0.10 <sup>c</sup>	7.33±0.12 <sup>bc</sup>	7.93±0.05 <sup>b</sup>	7.55±0.15 <sup>b</sup>
0.7%	6.80±0.20 <sup>d</sup>	7.00±0.15 <sup>c</sup>	6.81±0.17 <sup>c</sup>	6.93±0.16 <sup>c</sup>

**Note:** Values with a different superscript (a,b) in a column are significantly different ( $p < 0.05$ ).

Body and texture score decreased ( $p \leq 0.05$ ) from 7.81 for control to 7.33. Reduction in body and texture score of ajwain paneer was due to slight softening of paneer. It might be due to spice particle interference in development of body and texture of the paneer. Eresam *et al.* (2015) [5] reported that addition of spice in paneer reduced the body and texture score. Flavor score of paneer increased from 7.58 for control paneer to 7.93 for ajwain paneer, which may be due to ajwain flavor. The overall acceptability scores also decreased ( $p \leq 0.05$ ) from 7.93 for control to 7.55 for ajwain paneer, which might be due to reduction of color and soft body of ajwain paneer (Table-1).

### Changes in sensory quality of ajwain paneer during storage at 7±1 °C

Sensory analysis of control and ajwain paneer during storage at ambient temperature (30±1 °C) and refrigeration temperature (7±1 °C) was done by seven judges for evaluating sensory characteristics such as color and appearance, body and texture, flavor and overall acceptability.

**Color and appearance:** Color and appearance scores of control and ajwain paneer during storage is given in Tables-2 and 3, which showed that the scores significantly decreased during storage ( $p \leq 0.05$ ) both at ambient and refrigeration temperature. Color and appearance score of control and

ajwain paneer decreased from 8.03 to 5.60 and from 7.20 to 5.72, respectively, after two days storage at ambient temperature (Table-2). Color and appearance of control and ajwain sample became yellowish-green on surface on second day. While during storage at refrigeration temperature, score of control on the 12<sup>th</sup> day and ajwain paneer on the 14<sup>th</sup> day decreased from 8.03 to 6.21 and from 7.20 to 6.58, respectively (Table-3). Dry surface appearance was observed in both samples during storage at refrigeration temperature.

**Body and texture:** Body and texture scores of control and ajwain paneer during storage is presented in Tables-2 and 3, which showed that scores significantly decreased during storage ( $p \leq 0.05$ ) at ambient and refrigeration temperature. Body and texture score of control and ajwain paneer decreased from 7.88 to 5.87 and from 7.33 to 5.75, respectively after two days storage at ambient temperature (Table-2). Body of control and ajwain paneer became soft and sticky. During storage at refrigeration, score of control on 12<sup>th</sup> day and ajwain paneer on 14<sup>th</sup> day decreased from 7.88 to 6.93 and from 7.33 to 6.61, respectively. Body and texture score of both paneer decreased due to hardening of paneer. It may be due to slightly evaporation of moisture from paneer (Table-3). Mishra *et al.* (2017) [11] also reported that Body and texture of paneer decreased during storage at ambient and refrigeration temperature.

**Table 2:** Effect of incorporation of ajwain on sensory acceptance score of paneer during storage at 30±1 °C

Sensory attribute	Type of paneer	Storage period (days)		
		0	1	2
Color and appearance	Control	8.03±0.05 <sup>aA</sup>	7.50±0.15 <sup>bA</sup>	5.60±0.13 <sup>cA</sup>
	Ajwain	7.20±0.10 <sup>aB</sup>	6.70±0.18 <sup>bB</sup>	5.72±0.15 <sup>cA</sup>
Body and texture	Control	7.88±0.12 <sup>aA</sup>	7.23±0.10 <sup>bA</sup>	5.87±0.17 <sup>cA</sup>
	Ajwain	7.33±0.12 <sup>aB</sup>	6.90±0.18 <sup>bB</sup>	5.75±0.10 <sup>cA</sup>
Flavor	Control	7.63±0.16 <sup>aA</sup>	7.13±0.10 <sup>bA</sup>	5.10±0.15 <sup>cA</sup>
	Ajwain	7.93±0.05 <sup>aB</sup>	7.25±0.15 <sup>bA</sup>	5.40±0.12 <sup>cB</sup>
Overall acceptability	Control	7.98±0.10 <sup>aA</sup>	7.40±0.15 <sup>bA</sup>	5.63±0.22 <sup>cA</sup>
	Ajwain	7.55±0.15 <sup>aB</sup>	7.15±0.15 <sup>bA</sup>	5.71±0.12 <sup>cA</sup>

**Note:** Values with a different superscript (a, b) in a row or column (A,B between control and treated) are significantly different at

$p < 0.05$ .

**Flavor:** Flavor scores of control and ajwain paneer during storage is shown in Tables-2 and 3, which showed that scores significantly decreased during storage ( $p \leq 0.05$ ) at ambient and refrigeration temperature. Flavor scores of control and ajwain paneer decreased from 7.63 to 5.10 and from 7.93 to 5.40, respectively after two days storage at ambient temperature (Table-2). At refrigeration storage, score of control on 12<sup>th</sup> day and ajwain paneer on 14<sup>th</sup> day decreased from 7.63 to 5.15 and from 7.93 to 5.31, respectively (Table-3). At refrigeration temperature spoilage occurred due to flavor defect; in which paneer became bitter in taste.

**Table 3:** Effect of incorporation of ajwain extract on sensory score of paneer during storage at 7±1 °C

Sensory attribute	Type of paneer	Storage period (days)				
		0	4	8	12	14
Color and appearance	Control	8.03±0.05 <sup>aA</sup>	7.88±0.12 <sup>abA</sup>	7.65±0.17 <sup>bA</sup>	6.21±0.10 <sup>cA</sup>	-
	Ajwain	7.20±0.10 <sup>aB</sup>	7.06±0.12 <sup>abB</sup>	6.95±0.13 <sup>abB</sup>	6.78±0.10 <sup>bcB</sup>	6.58±0.16 <sup>c</sup>
Body and texture	Control	7.88±0.13 <sup>aA</sup>	7.45±0.15 <sup>bA</sup>	7.06±0.16 <sup>cA</sup>	6.93±0.15 <sup>cA</sup>	-
	Ajwain	7.33±0.12 <sup>aB</sup>	7.21±0.13 <sup>abA</sup>	6.95±0.13 <sup>bcA</sup>	6.81±0.17 <sup>cA</sup>	6.61±0.12 <sup>c</sup>
Flavor	Control	7.63±0.05 <sup>aA</sup>	7.33±0.12 <sup>abA</sup>	7.13±0.13 <sup>bA</sup>	5.15±0.13 <sup>cA</sup>	-
	Ajwain	7.93±0.05 <sup>aB</sup>	7.73±0.10 <sup>aB</sup>	7.31±0.12 <sup>bA</sup>	7.05±0.18 <sup>bB</sup>	5.31±0.12 <sup>b</sup>
Overall acceptability	Control	7.98±0.10 <sup>aA</sup>	7.53±0.05 <sup>bA</sup>	7.21±0.10 <sup>cA</sup>	5.40±0.13 <sup>dA</sup>	-
	Ajwain	7.55±0.15 <sup>aB</sup>	7.45±0.15 <sup>aA</sup>	7.05±0.13 <sup>bA</sup>	6.96±0.12 <sup>bB</sup>	5.50±0.13 <sup>c</sup>

**Note:** Values with a different superscript (a, b) in a row or column (A, B between control and treated) are significantly different at  $p < 0.05$

**Overall acceptability:** Overall acceptability scores of control and ajwain paneer during storage is given in Tables-2 and 3, which showed that scores significantly decreased during storage ( $p \leq 0.05$ ) at ambient and refrigeration temperatures. Overall acceptability scores of control and ajwain paneer decreased from 7.98 to 5.63 and from 7.55 to 5.71 respectively, after two days storage at ambient temperature (Table-2). At refrigeration storage, score of control on 12<sup>th</sup> day and ajwain paneer on 14<sup>th</sup> day storage decreased from 7.98 to 5.40 and from 7.55 to 5.50, respectively (Table-3). Decreasing sensory scores of paneer during storage period was also reported by Bhattacharya *et al.* (1971) [2] and Thippeswamy *et al.* (2011) [15]. Table-2 shows that shelf life of control and ajwain paneer was only one day at ambient temperature. While shelf life of control and ajwain paneer were 8 and 12 days at refrigeration temperature, respectively (Table-3). Enhancement of shelf life of ajwain paneer may be due to low temperature, antimicrobial property of ajwain and synergistic effect of these factors. Farahmandfar *et al.* (2016) [6] also reported that ajwain extract enhanced the shelf life of silver carp surimi.

**Changes in microbial count of ajwain paneer during storage at 7±1 °C**

Control and ajwain paneer were analyzed for standard plate count (SPC) and yeast and mold count. The data obtained for

changes in SPC and yeast and mold count are presented in Figs. 1 and 2.

**Standard plate count**

It is clear from Fig.1 that SPC of control and ajwain paneer increased during the storage at refrigeration temperature. The count increased from 4.71 to 5.29 log<sub>10</sub> cfu/g after 8 days in control paneer and from 4.67 to 5.37 log<sub>10</sub> cfu/g after 12 days in ajwain paneer, which was below the limit of microbial count set by Bureau of Indian Standards for paneer. Kumar and Bector (1991) also reported an increase in SPC in paneer during storage at 15 °C.

**Yeast and mold count**

Fig. 2 showed that yeast and mold count increased sharply in case of control paneer, while in the ajwain paneer count increased at a slower rate throughout the storage period. Count increased from 62 to 213 cfu/g after 8 days in control paneer and from 49 to 226 cfu/g after 12 days in ajwain paneer. Kumar and Bector (1991) also reported that the yeast and mold count of paneer increased from 10 to 50 per g after 4 days and 250 per g after 7 days of storage at 15°C. Sachdeva and Singh (1990) also reported that SPC and yeast and mold count increased in paneer during storage at 8-10 °C. Mishra *et al.* (2017) [11] also reported that SPC and yeast and mold count increased in paneer during storage at 7 °C.

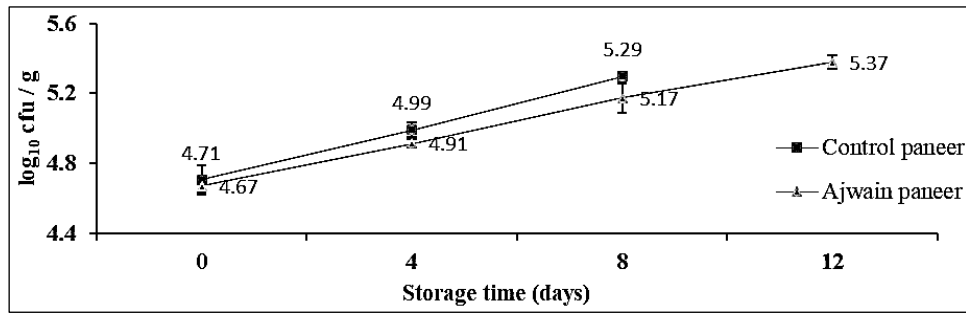


Fig 1: Changes in standard plate count of ajwain paneer during storage at 7±1 °C

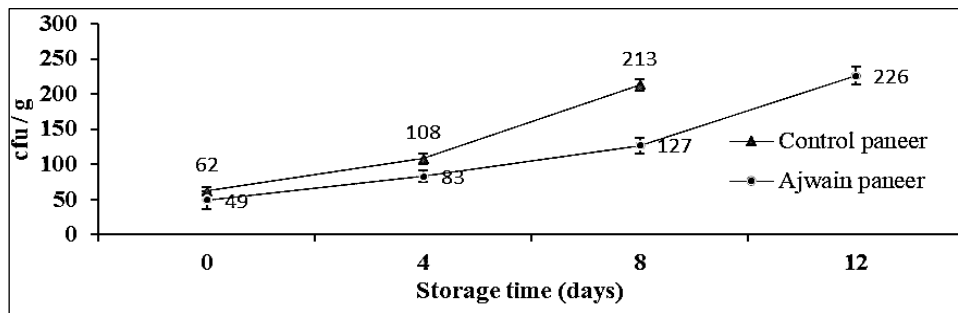


Fig 2: Changes in yeast and mold count of ajwain paneer during storage at 7±1 °C

## Conclusion

Shelf life of treated sample was only one day at room temperature which is similar to control paneer. While at refrigeration temperature, shelf life of treated sample was 12 days and control was only 8 days. Thus, ajwain extract did not enhance the shelf life of paneer at room temperature, while it slightly enhanced at refrigeration temperature in respect of control.

## References

- Almeida-Doria RF, Regitano-D'arce MA. Antioxidant activity of rosemary and oregano ethanol extracts in soybean oil under thermal oxidation. *Food Science and Technology*. 2000;20(2):197-203.
- Bhattacharya DC, Mathur ON, Srinivasan MR, Samlik O. Studies on the Methods of Production and Shelf life of Paneer (Cooking Type of Acid Coagulated cottage cheese). *Journal of Food Science Technology*. 1971;8(5):117-120.
- Cowan MM. Plant products as antimicrobial agents. *Clinical microbiology reviews*. 1999;12(4):564-82.
- Deans SG, Noble RC, Hiltunen R, Wuryani W, Penzes LG. Antimicrobial and antioxidant properties of *Syzygium aromaticum* (L.) Merr. & Perry: impact upon bacteria, fungi and fatty acid levels in ageing mice. *Flavour and Fragrance Journal*. 1995;10(5):323-328.
- Eresam EK, Pinto S, Aparnathi KD. Concise and informative title: evaluation of selected spices in extending shelf life of paneer. *Journal of food science and technology*. 2015;52(4):2043-2052.
- Farahmandfar R, Safari R, Ahmadi Vavsari F, Bakhshandeh T. The Effect of Ajwain (*Trachyspermum ammi*) Extracted by Ultrasound-Assisted Solvent on Quality Properties of Silver Carp (*Hypophthalmichthys molitrix*) Surimi Stored at 4 °C. *Journal of food processing and preservation*, 2015.
- ISI. IS 1224 (Part I and II). Methods for test of dairy industry. Bacteriological analysis of milk and milk products. Bureau of Indian Standards, New Delhi, 1981(a).
- Kumar P, Bector BS. Enhancement of shelf-life of paneer with food additives. *Indian Journal of Dairy Science*. 1991;44(9):577-84.
- Lawless HT, Heymann H. Sensory evaluation of food: principles and practices. Springer Science & Business Media, 2010, 27.
- Mishra D, Rao KJ, Bhardwaj R, Deshmukh GP, Kumar R, Eknath KP. Effect of Water Activity on Sensory, Textural Properties and Shelf Life of Paneer. *International journal of pure and applied bioscience*. 2017;5(4):238-45.
- Mishra D, Rao KJ, Bhardwaj R, Sutariya H, Kavitar R, Subhash WS. Effect of pH on sensory, textural, microbial quality and shelf-life of paneer. *International Journal of Food and Fermentation Technology*. 2016; 6(2):405-414.
- Sachdeva S, Singh S. Shelf life of paneer as affected by antimicrobial agents. *Indian J Dairy Sci*. 1990;43(1):60-63.
- Shelf LA. Antimicrobial effects of spices 1. *Journal of food safety*. 1984;6(1):29-44.
- Souza EL, Stamford TL, Lima ED, Trajano VN, Barbosa Filho JM. Antimicrobial effectiveness of spices: an approach for use in food conservation systems. *Brazilian Archives of Biology and Technology*. 2005;48(4):549-558.
- Thippeswamy L, Venkateshaiah BV, Patil SB. Effect of modified atmospheric packaging on the shelf-stability of paneer prepared by adopting hurdle technology. *J Food Sci. Technol*. 2011;48(2):230-235.