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Chemical Quality Changes in Clove Paneer during Storage

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Abstract

Paneer is a nutritious, palatable, and widely consumed indigenous dairy product obtained by heat-acid coagulation of milk. Paneer have shelf life about only one day at ambient temperature and up to one week under refrigerated conditions. Various type of preservation hurdles, like temperature, pH, incorporation of spices, and appropriate packaging, can be used to enhance the shelf life of paneer. Among these, clove is a major spice extensively used for imparting a characteristic flavour to food products. Clove have several functional properties, including antioxidant, anti-inflammatory, antimicrobial, and antifungal activities, which make it natural preservative for extending the shelf life of paneer. Clove extract was prepared and incorporated into milk at levels of 0.3, 0.4, and 0.5% (w/w of milk) prior to paneer manufacture. Paneer was prepared by the standardized method. Paneer incorporated with clove extract at 0.3% was found most acceptable on sensory basis and was selected. The shelf life of control and 0.3% clove-treated paneer packed in polystyrene cups was found 8 and 14 days, respectively, at refrigerated temperature. During storage at refrigeration temperature, decrease in moisture content and pH was observed, while titratable acidity content increased in both control and clove-treated paneer samples.

Keywords: Clove extract, Moisture, pH, Paneer, Acidity

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Introduction

Paneer is a heat acid-coagulated indigenous milk product extensively used as a cooking ingredient along with vegetables. It has shelf life only one day at room temperature and up to a week at refrigeration temperature, due to high moisture content (about 55%) [1]. Hurdles like humectants, spices, microwave, different type of packaging etc. can be used for enhancing the shelf life of paneer. Many plant-derived antimicrobials have been shown to be highly effective in controlling food-borne pathogenic bacteria and in extending the shelf life of food and dairy products [2]. Plant extracts are generally regarded as relatively safe for human consumption [3]. Many essential oils obtain from various plants have been reported to be safe and exhibit strong antimicrobial activity [4]. Spices are currently used mainly for enhancing the flavor of foods rather than extending shelf life [5]. In addition to imparting flavor, certain spices enhance the shelf life of food products due to their bacteriostatic or bactericidal activity, and some prevent rancidity by their antioxidant activity [6]. Generally spices show antimicrobial activity due to phenolic component [7]. Clove is widely used as a flavoring agent in pastries, condiments, and sauces. It is also used in medicine, particularly in dental care products for the treatment of toothache, gum disorders, and oral infections due to its analgesic and antimicrobial properties. The main antimicrobial component of clove is eugenol. Clove essential oil and clove extracts show broad antibacterial and antifungal activity against common food-borne and spoilage organisms [8]. Clove essential oil reduces counts of spoilage bacteria and pathogens and extend shelf life of food products [9]. Spoilage in paneer occurs primarily due to the growth of microorganisms, which start various physico-chemical changes and lead to the development of off-flavours in the paneer. Spices are well recognized for their medicinal, preservative, and antioxidant properties [10]. The bioactive properties of clove powder are mainly due to eugenol, which exhibit strong antimicrobial and antioxidant activity [11]. The present study was therefore undertaken to investigate the effect of clove extract on changes in the chemical quality of paneer during storage under refrigeration conditions.

Materials and Methods

Preparation of paneer

Paneer was prepared from toned milk by a standardized method [1]. Fresh toned milk was purchased 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. Milk was coagulated with by adding 1 % citric acid (2 g/litre of mik) solution at 80°C. Acid solution was slowly added to the heated milk with continuous slow stirring until the curd and clear slightly yellow-greenish whey separated out. Then mixture of curd and whey was allowed to settle down for 5 minutes and whey was drained out through using muslin cloth. After removal of whey, pressing of curd was done with the weight at 35-40 g/cm^2 pressure 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 paneer removed from water and placed on a wooden plank for 10-15 min for draining occluded water from paneer and cut into 1cm cubes for further studies.

Preparation and Incorporation of Clove Extract

Required quantity of ground clove (@ 0.3, 0.4 and 0.5% by weight of milk) was weighed and put into a beaker. Water (about 3 times weight of spice) was mixed to ground clove and kept at room temperature for 12 hours. This soaked ground clove was again ground in a grinder and filtered through muslin cloth. This filtrate of ground clove was added to milk during boiling of milk for clove paneer preparation.

Clove paneer preparation

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

Sensory Evaluation

Nine-point Hedonic scale method [12] was used for sensory evaluation of all *paneer* samples by a panel of 7 semi trained judges.

Moisture Content

The gravimetric method as per IS: 10484 [13] was used for determining the moisture content of paneer samples.

pH

The pH of paneer samples was determined as described by Awad [14].

Titratable acidity

The titratable acidity of paneer samples was determined by the titration method as prescribed by BIS [15].

Result and Discussion

Effect of clove extract on sensory quality of paneer

Clove extract @ 0.3, 0.4 and 0.5% by weight of milk, was incorporated into *paneer*. The clove incorporated *paneer* was then subjected to sensory evaluation by judges. It was found that *paneer* incorporated with clove extract at 0.3% got maximun flavor score (**Figure 1**). So, 0.3% clove incorporated *paneer* was chosen for further studies. The colour and appearance score of 0.3% clove-incorporated paneer was lower than that of the control paneer. This reduction may be due to the change in colour of paneer from white to slightly dark due to the addition of clove extract. The colour and appearance score decreased from 8.03 in control paneer to 7.21 in clove paneer (Figure 1). Reduction in body and texture score was also found in clove paneer (7.45) compared to control paneer (7.58). The decrease in body and texture score may be due to increased hardness of paneer caused by clove extract addition. Similar observations were reported by Havanur and Adi [16], in clove oil added paneer. The flavour score of paneer reduced from 7.88 in control paneer to 7.58 in clove-incorporated paneer. This reduction may be due to the intense characteristic flavour of clove. Overall acceptability scores of clove paneer were lower than those of the control. The overall acceptability score decreased from 8.00 in control paneer to 7.61 in clove paneer (Figure 1). The reduction in overall acceptability may be due to changes in colour and increased hardness of the paneer resulting from clove extract addition. Based on experimental observations, the shelf life of control and 0.3% clove-treated paneer in polystyrene cups was found 8 and 14 days, respectively, under refrigerated temperature.

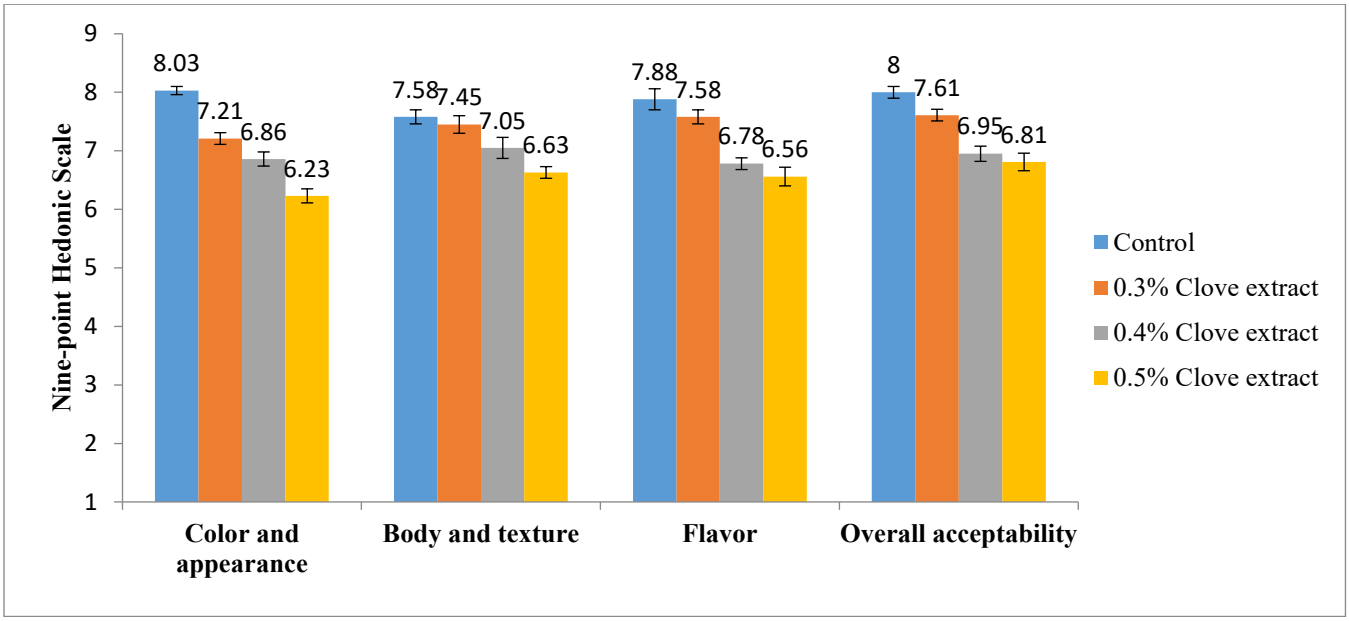

Figure 1 Effect of incorporation of clove extract on sensory score of paneer

Changes in chemical characteristics of clove paneer during storage at refrigeration temperature

Moisture content

The moisture content of control and clove-incorporated paneer during refrigerated storage is given in **Figure 2**. The initial moisture content of control paneer and clove-added paneer was 53.16% and 53.02%, respectively. Reduction in moisture content was observed in both control and clove-added paneer during storage at refrigeration temperature. In control paneer, the moisture content decreased from 53.16% to 53.04% after 8 days of storage. Similarly, in clove-incorporated paneer, the moisture content decreased from 53.02% to 52.84% after 14 days of storage. The reduction in moisture content during storage may be due to moisture evaporation from paneer surface under refrigerated conditions. Similarly Rai [17] also reported decreasing the moisture content of *paneer* during storage.

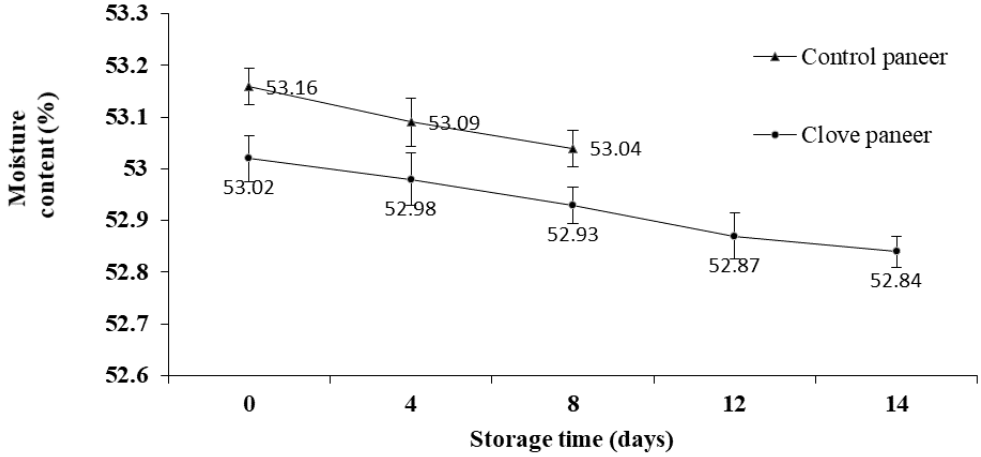

Figure 2 Changes in moisture content of clove *paneer* during storage at 7±1°C

Titratable acidity

The titratable acidity of control paneer and clove- incorporated paneer during refrigerated temperature is given in **Figure 3**. The initial titratable acidity of control and clove paneer was 0.471% and 0.498% lactic acid, respectively. In control paneer, acidity increased from 0.471% to 0.976% lactic acid after 8 days of storage. Similarly, in clove-incorporated paneer, titratable acidity increased from 0.498% to 1.17% lactic acid after 14 days of storage. The increase in titratable acidity in paneer was an indication of bacterial spoilage by lactose fermenting organisms. The rate of acidity development in treated paneer was slower than in control paneer. Sachdeva and Singh [18] and Mishra et al., [19] also observed increase in titratable acidity of paneer samples during storage. Karunamay et al., [20] also reported increase in titratable acidity of paneer coated with edible film treated with 0.5 % clove essential oil samples during storage.

pH

The pH values of control paneer and clove-incorporated paneer during refrigerated storage are given in **Figure 4**. The initial pH of control and clove paneer was 5.76 and 5.69, respectively. Reduction in pH was observed in both control and clove-added paneer during storage at refrigeration temperature. In control paneer, the pH declined from 5.76 to 5.65 after 8 days of storage. Similarly, in clove-incorporated paneer, the pH decreased from 5.69 to 5.52 after 14 days of storage. The reduction in pH during storage may be due to the production of acids resulting from microbial fermentation of lactose. The relatively slower decrease in pH in clove paneer possibly due to the antimicrobial effect of clove extract. Arora and Gupta [21] and Mishra et al., [19] also reported decrease in pH of paneer samples during storage. Archana et al., [22] found a similar decrease in pH of paneer coated with casein based coating with clove bud essential oil paneer during storage.

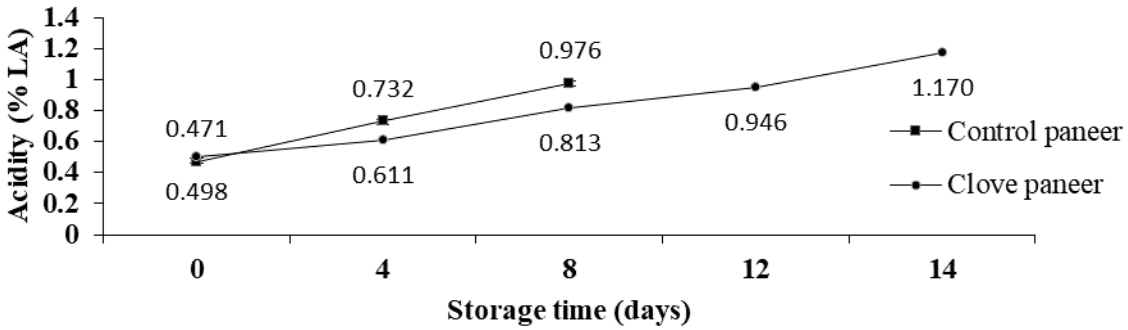

Figure 3 Changes in acidity of clove *paneer* during storage at 7±1°C

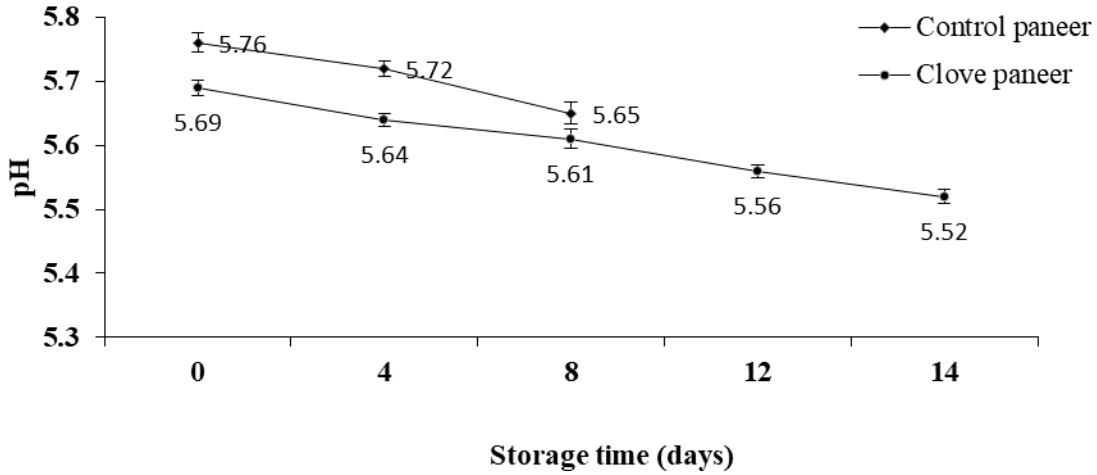

Figure 4 Changes in pH of clove *paneer* during storage at 7±1°C

Conclusion

From the results it may be concluded that moisture content and pH decreased while acidity content of both control paneer and clove *paneer* increased during storage at refrigeration temperature.

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