

Research Article

Comparison study of Sensory Qualities of Whey Protein Based Edible Coated Paneer Incorporated with essential oils (Ginger, Garlic and Cinnamon oil)

A. Punnagaiarasi* A. Elango, A. Kalaikannan and M. Selvaraju

Department of Livestock Products Technology (Dairy Science), Veterinary College and Research Institute, Namakkal - 637 002, Tamil Nadu

Abstract

A study was conducted to compare the sensory quality of paneer by edible coating technology. Whey protein edible coating was prepared by using whey protein concentrate (6 per cent), glycerol (7 per cent) as plasticizer and plant essential oils (Ginger, Garlic and Cinnamon oil) as anti-microbial agent. Preliminary trials (Control, T1, T2, T3, T4, T5 and T6) were conducted using essential oils (ginger, garlic and cinnamon oil) each at six different levels (0.2%, 0.4%, 0.6%, 0.8% 1.0 and 1.2 %). Based on the sensory evaluation, incorporation of ginger, garlic and cinnamon oil up to a level of 1 per cent into edible coating recorded significantly higher ($p < 0.05$) scores in overall acceptability.

Keywords: Sensory quality, Whey protein, edible coated paneer, Essential oils

*Correspondence

Author: A. Punnagaiarasi
Email: punnagai90@rediffmail.com

Introduction

Paneer is an important traditional acid coagulated nutritionally superior milk product of mostly unorganized dairy sector which contributes for improving the economical and social status of Indian rural masses. This traditional dairy product has high water activity leading to rapid deterioration at ambient temperature due to unhygienic practices followed during manufacturing. Since the demand for this product is steadily increasing, there is a great need to produce high quality long life products that requires hygienic modern processing, preservation and packaging technologies. The shelf life of paneer is only one day at room temperature and six days at 5°C, which is one of the most serious problems faced in marketing. According to FSSR [1], paneer is defined as a product obtained from cow or buffalo milk or combinations thereof by precipitation with sour milk, lactic acid or citric acid. It shall not contain more than 70 per cent moisture and milk fat content shall not be less than 50 per cent of the dry matter. The milk fat content of skim milk paneer shall not exceed 13 per cent of dry matter. Paneer contains all the milk constituents except some soluble whey proteins, lactose and minerals [2]. Paneer has a fairly high level of fat (22–25%) and protein (16–18%) and a low level of lactose (2.0–2.7%) [3].

This paper describes the Effect of whey protein based edible coat material incorporated with essential oils (ginger, garlic and cinnamon oil) on sensory properties of paneer.

Material and Methods

Fresh milk containing above 4 per cent fat and 7.9 per cent Solids Not Fat obtained from crossbred cows maintained at the Instructional Livestock Farm Complex, Veterinary College and Research Institute, Namakkal, Tamil Nadu was used for the study.

Whey protein concentrates (WPC)

Whey protein concentrates (containing 82 percent protein) obtained from the Kanishka Flora Chem Inida, Chennai, Tamil Nadu was used.

Essential oil (EO)

Ginger, Garlic and Cinnamon oil – certified food grade essential oils were purchased from M/S Akay flavor and aromatics private Limited, Kochi.

Chemicals

Chemicals of analytical reagents (AR) grade procured from HiMedia were used for various analysis and preservation studies.

Methods

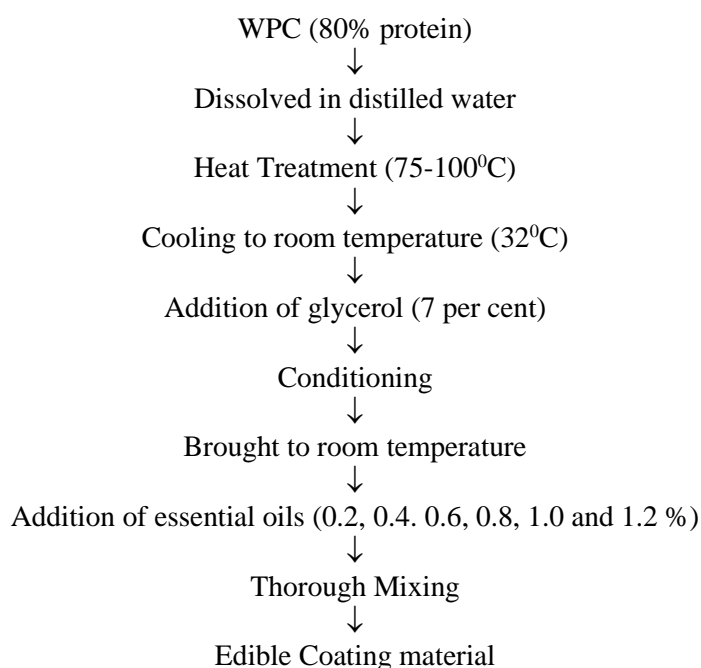
Selection of ingredients

In order to prepare paneer (4 litre cow milk), citric acid 1 per cent (1.5ml/lit) were used. Whey protein concentrate (WPC) was used at 6 per cent level, glycerol (G) was used at 7.0 per cent (Reeta and Kumar) [4] and Essential oils (ginger, garlic and cinnamon oil) were used at different percentage (0.2 to 1.2 per cent).

Preparation of paneer

Paneer was prepared as per procedure [5].

Preparation of WPC edible coating material



Application of Edible Coating on Paneer

The edible coat material prepared as per previous research paper [4].

Sensory evaluation of paneer

Paneer was coated with edible coated material after inoculating different levels of ginger, garlic and cinnamon oil at 0.2, 0.4, 0.6, 0.8, 1.0 and 1.2 per cent respectively, to study the optimum level for inoculation based on sensory qualities. Panellists were asked to evaluate paneer quality on a 9-point hedonic scale with their preferences according to the scale [6].

Statistical analysis

The data obtained in all the experiments were analyzed statistically analyzed by ANOVA [7].

Results and Discussion

Standardization Essential oils (ginger, garlic and cinnamon oil) inclusion level in whey protein based edible coat material

Mean \pm SE values of colour and appearance, flavor, body and texture and over all acceptability scores of different concentration of ginger, garlic and cinnamon oil {0.2 (T1), 0.4(T2), 0.6(T3), 0.8(T4), 1.0(T5), and 1.2(T6) per cent} included in whey protein based edible coat material are presented in **Table 1** and **Figure 1** for ginger oil, **Table 2** and **Figure 2** for garlic oil, **Table 3** and **Figure 3** for cinnamon oil.

Table 1 Sensory evaluation of paneer samples enrobed with whey protein based edible coating incorporated with ginger oil

| Treatment | Sensory parameters | | | |
|-----------|------------------------------|--------------------------------|------------------------------|--------------------------------|
| | Color and appearance (9) | Body and texture (9) | Flavor (9) | Overall acceptability (9) |
| Control | 7.91 \pm 0.08 ^a | 7.58 \pm 0.23 ^a | 7.75 \pm 0.17 ^a | 8.00 \pm 0.18 ^a |
| T1 | 7.66 \pm 0.10 ^a | 7.41 \pm 0.27 ^{ab} | 7.75 \pm 0.21 ^a | 7.00 \pm 0.12 ^c |
| T2 | 6.83 \pm 0.21 ^b | 7.25 \pm 0.21 ^{abc} | 7.66 \pm 0.24 ^a | 7.33 \pm 0.21 ^{bc} |
| T3 | 6.58 \pm 0.15 ^b | 6.91 \pm 0.15 ^{abc} | 8.08 \pm 0.15 ^a | 7.50 \pm 0.12 ^{abc} |
| T4 | 6.00 \pm 0.18 ^c | 6.75 \pm 0.17 ^{bc} | 8.00 \pm 0.22 ^a | 7.83 \pm 0.10 ^{ab} |
| T5 | 5.91 \pm 0.30 ^c | 6.58 \pm 0.23 ^c | 8.08 \pm 0.15 ^a | 7.83 \pm 0.16 ^{ab} |
| T6 | 3.91 \pm 0.23 ^d | 3.66 \pm 0.24 ^d | 4.33 \pm 0.24 ^b | 4.58 \pm 0.39 ^d |

Within a Colum value (Means \pm SE) with different superscript letters are significantly different (p<0.05)

Figure 1 Sensory evaluation of whey protein based edible coated paneer samples by 9 point hedonic scale (ginger oil)

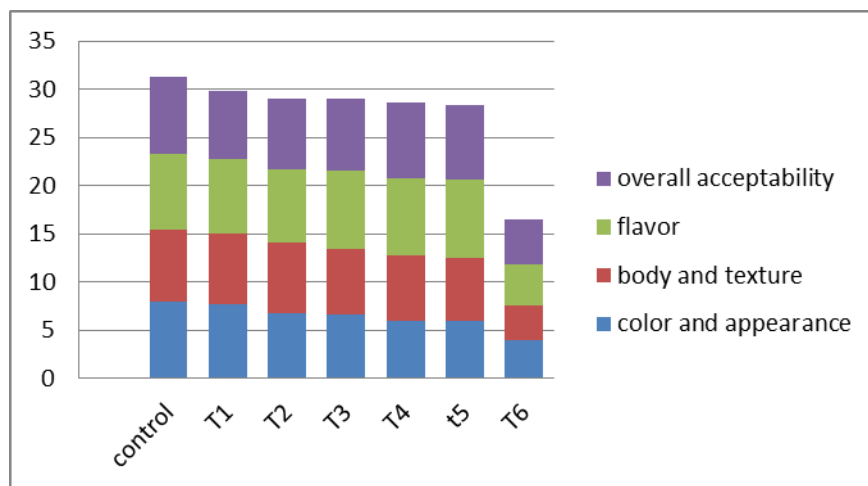


Table 2 Sensory evaluation of paneer samples enrobed with whey protein based edible coating incorporated with garlic oil

| Treatment | Sensory parameters | | | |
|-----------|-------------------------------|-------------------------------|------------------------------|-------------------------------|
| | Color and appearance (9) | Body and texture (9) | Flavor (9) | Overall acceptability (9) |
| Control | 7.91 \pm 0.08 ^a | 7.58 \pm 0.23 ^a | 7.75 \pm 0.17 ^a | 8.00 \pm 0.18 ^a |
| T1 | 7.25 \pm 0.21 ^b | 7.08 \pm 0.23 ^{ab} | 7.58 \pm 0.23 ^a | 6.75 \pm 0.17 ^c |
| T2 | 6.75 \pm 0.21 ^{bc} | 6.83 \pm 0.21 ^b | 7.66 \pm 0.16 ^a | 6.91 \pm 0.15 ^{bc} |
| T3 | 6.58 \pm 0.30 ^c | 6.58 \pm 0.23 ^b | 7.66 \pm 0.21 ^a | 7.16 \pm 0.16 ^{bc} |
| T4 | 6.16 \pm 0.24 ^c | 6.41 \pm 0.23 ^{bc} | 7.75 \pm 0.21 ^a | 7.33 \pm 0.16 ^{bc} |
| T5 | 4.75 \pm 0.21 ^d | 5.83 \pm 0.24 ^c | 7.75 \pm 0.21 ^a | 7.41 \pm 0.15 ^b |
| T6 | 2.00 \pm 0.12 ^e | 3.00 \pm 0.28 ^d | 3.58 \pm 0.30 ^b | 3.41 \pm 0.30 ^d |

Within a Colum value (Means \pm SE) with different superscript letters are significantly different (p<0.05)

Colour and appearance

Statistical analysis revealed that inclusion of essential oils (ginger, garlic and cinnamon oil) in edible coat material significantly (P<0.05) reduced the colour and appearance scores over control and T1 whereas there was no significant difference between T2 and T3. Similarly, there was no significant difference between T4 and T5. But, addition of

ginger oil and cinnamon oil at 1.2 per cent level significantly ($P < 0.05$) reduced the color and appearance score over all the other treatments and control. In case of garlic oil at 1 per cent and 1.2 per cent levels significantly ($P < 0.05$) reduced the color and appearance.

Figure 2 Sensory evaluation of whey protein based edible coated paneer samples by 9 point hedonic scale (garlic oil)

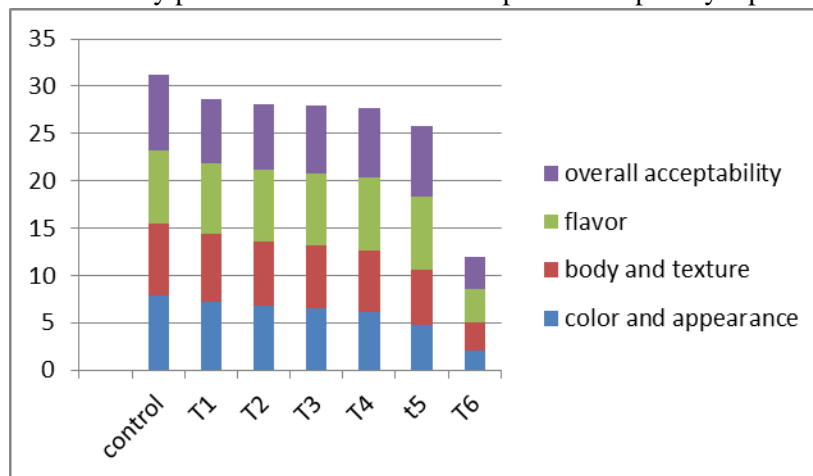
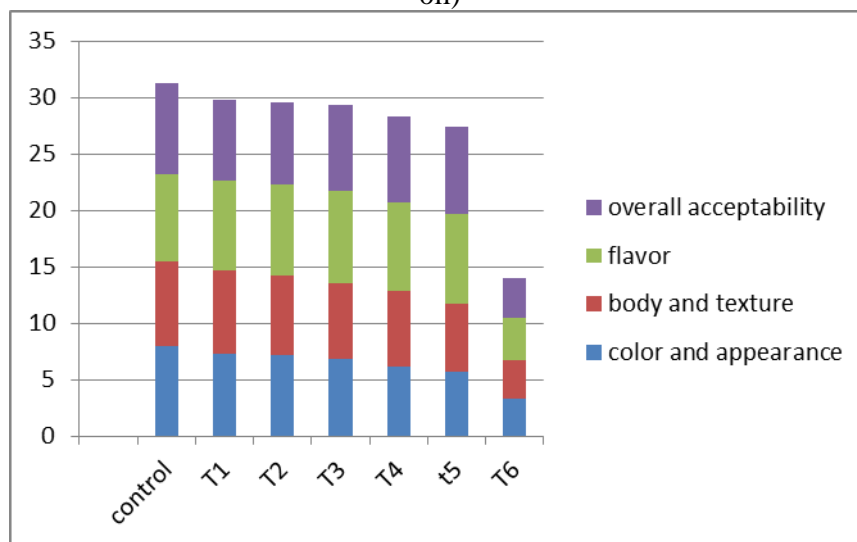


Table 3 Sensory evaluation of paneer samples enrobed with whey protein based edible coating incorporated with cinnamon oil

| Treatment | Sensory parameters | | | |
|-----------|--------------------------|--------------------------|------------------------|---------------------------|
| | Color and appearance (9) | Body and texture (9) | Flavor (9) | Overall acceptability (9) |
| Control | 7.91±0.08 ^a | 7.58±0.23 ^a | 7.75±0.17 ^a | 8.00±0.18 ^a |
| T1 | 7.33±0.16 ^b | 7.33±0.16 ^{ab} | 7.91±0.15 ^a | 7.25±0.11 ^b |
| T2 | 7.16±0.16 ^b | 7.00±0.18 ^{abc} | 8.08±0.15 ^a | 7.33±0.16 ^b |
| T3 | 6.83±0.21 ^b | 6.75±0.21 ^{bc} | 8.16±0.16 ^a | 7.58±0.15 ^{ab} |
| T4 | 6.16±0.24 ^c | 6.66±0.27 ^{cd} | 7.83±0.24 ^a | 7.66±0.16 ^{ab} |
| T5 | 5.66±0.24 ^c | 6.08±0.15 ^d | 7.91±0.23 ^a | 7.75±0.21 ^{ab} |
| T6 | 3.25±0.21 ^d | 3.50±0.18 ^e | 3.75±0.11 ^b | 3.50±0.18 ^c |

Within a Colum value (Means±SE) with different superscript letters are significantly different ($p < 0.05$)

Figure 3 Sensory evaluation of whey protein based edible coated paneer samples by 9 point hedonic scale (cinnamon oil)



Body and Texture

Statistical analysis revealed that inclusion of essential oils (ginger, garlic and cinnamon oil) at 1.2 percent level in edible coat material significantly ($P < 0.05$) reduced the body and texture scores over control and all other treatments.

Flavour

Statistical analysis revealed that inclusion of essential oils (ginger, garlic and cinnamon oil) at 1.2 percent level in edible coat material significantly ($P<0.05$) reduced the flavour scores over control and all other treatments. Even though there was marked increase in the flavor score upto 1 percent level of inclusion, the differences were not significant.

Over all acceptability

Overall acceptability scores of paneer coated with ginger oil was not significantly reduced over the control at 0.6 per cent, 0.8 percent and 1.0 percent level of inclusion, whereas beyond 1 per cent level it showed poor sensory qualities over control and all other treatments. However, the ginger oil inclusion at 0.2 and 0.4 levels significantly reduced the overall acceptability scores over control. But Inclusion of garlic oil significantly reduced the overall acceptability scores of over the control. However, the garlic oil inclusion in the edible coating at 1.2 significantly ($P<0.05$) had poor sensory qualities over the control and all other treatments. In case of cinnamon oil at 0.2 and 0.4 percent significantly ($P<0.05$) reduced the overall acceptability scores of paneer over the control. However, the cinnamon oil inclusion in the edible coating at 1.2 percent significantly ($P<0.05$) had poor sensory qualities over the control and all other treatments. But, addition of cinnamon oil at 0.6, 0.8 and 1 percent level did not show any significant ($P<0.05$) effect on overall acceptability scores over control.

Whey protein edible coating was prepared by using whey protein concentrate (6 per cent), glycerol (7 per cent) as plasticizer and essential oils (ginger, garlic and cinnamon oil) as anti microbial agent. Preliminary trials (Control, T1, T2, T3, T4, T5 and T6) were conducted using essential oils each at six different levels (0.2 per cent, 0.4 per cent, 0.6 per cent, 0.8 per cent, 1.0 per cent and 1.2 per cent). In line with the procedure employed by Reeta and Kumar [5], edible coating, the level of whey protein concentrate and glycerol were fixed at 6 and 7 per cent respectively in the formulation of edible coating. Further, the procedure of sensory evaluation employed for standardization of edible coat material with essential oils was comparable to that of Reeta and Kumar [5], who optimized the level of inclusion based on Response Surface Methodology (RSM) while preparing edible coating using whey protein concentrate (WPC), glycerol, potassium sorbate and nisin used as anti microbial agent to enrobe paneer.

On sensory evaluation, the colour and appearance of body and texture of paneer revealed that a significant ($p<0.05$) decrease in edible coated paneer was observed in all the treatments compared to control. This may be attributed to the natural colour of whey protein concentrate and essential oil. Further, statistical analysis revealed that inclusion of the essential oils (ginger, garlic and cinnamon oil) at 1.2 percent level in edible coat material significantly ($P<0.05$) reduced the flavour scores over control and all other treatments, Even though there was marked increase in the flavor score up to 1 percent level of inclusion, the difference were not significant. On the contrary, Naveena and Mendiratta [8] reported an increase in flavor and overall palatability with samples treated with ginger extract than control. The decrease in flavor score may be attributed to the addition of glycerol which might have masked the flavour. The edible coated paneer showed a significant reduction in body and texture it may be due to addition of glycerol in edible coat material. These results were in accordance with Reeta and Kumar [4], who reported that the glycerol added as plasticizer affected the body and texture while the whey protein concentrates had minimal impact on body and texture. The overall acceptability scores of paneer coated with ginger oil was not significantly reduced over the control at 0.6 per cent, 0.8 percent and 1.0 percent level of inclusion, whereas beyond 1 per cent level it showed poor sensory qualities over control and all other treatments.

Based on the sensory evaluation, it is revealed that as the concentration of the mentioned oil up to a level of 1 per cent incorporation into edible coating recorded significantly higher ($p<0.05$) scores in overall acceptability, the maximum level of inclusion of up to 1 per cent was optimized and further studies were carried out. Similarly, the level of incorporation of whey protein concentrate and glycerol were fixed at 6 and 7 per cent respectively. This was in line with observations of Santoro [9], who reported an improvement in the sensory score observed for cheese added with whey protein concentrate at the rate of 10g/l to milk. Romos *et al* [10] also reported that cheese coated with solution 2 or 3 (Lactic acid, natamycin or COS, lactic acid and natamycin) exhibited a yellow- brownish color. Furthermore, Reeta and kumar [4] reported that 6 percent whey protein concentrate showed better sensory appearance score than at 8 percent levels of whey protein concentrate.

Conclusion

Based on sensory evaluation, it is revealed that incorporation of essential oils (ginger, garlic and cinnamon oil) up to a level of 1 per cent into edible coating recorded significantly higher ($p<0.05$) scores in overall acceptability. From the

above study it is concluded that formulation of edible coating containing ginger oil (up to 1%) shows higher score in sensory evaluation compared with garlic and cinnamon oil incorporation.

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