www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(12): 71-76

www.thepharmajournal.com
Received: 25-10-2022
Accepted: 28-11-2022

**BB Chaudhari**
Department of Animal Husbandry and Dairy Science, College of Agriculture, Vasantrao Naik Marathwada Krushi Vidyapeeth, Parbhani, Maharashtra, India

**Dr. NS Kamble**
Assistant prof. Department of Animal Husbandry and Dairy Science, Vasantrao Naik Marathwada Krushi Vidyapeeth, Parbhani, Maharashtra, India

**SN Waychal**
Department of Animal Husbandry and Dairy Science, College of Agriculture, Latur, Vasantrao Naik Marathwada Krushi Vidyapeeth, Parbhani, Maharashtra, India

**SS Bansode**
Department of Animal Husbandry and Dairy Science, College of Agriculture, Latur, Vasantrao Naik Marathwada Krushi Vidyapeeth, Parbhani, Maharashtra, India

**Corresponding Author:**
**BB Chaudhari**
Department of Animal Husbandry and Dairy Science, College of Agriculture, Latur, Vasantrao Naik Marathwada Krushi Vidyapeeth, Parbhani, Maharashtra, India

# Standardization and estimation of production cost of paneer incorporated with spinach powder

**BB Chaudhari, Dr. NS Kamble, SN Waychal and SS Bansode**

**DOI:** https://doi.org/10.22271/tpi.2022.v11.i12a.17639

**Abstract**
The buffalo milk was used to prepare paneer incorporated with spinach powder which was collected from the local market of Latur. The chemical composition of such buffalo milk had fat 6 percent, solid not fat 9 percent and protein 3.50 percent. Addition of spinach powder was as per the treatments. For optimization of proper spinach powder level in paneer buffalo milk was heated above 90 ºC for 5 min and then cooled to 80 ºC then recommended amount of spinach powder was weighed and added as per treatments to milk followed by continuous stirring to ensure uniform mixing of spinach powder into the milk as per treatment and procedure prescribed in methodology. The cost of paneer preparation under the treatments $T_1$, $T_2$, $T_3$ and $T_4$ were as Rs. 83.6, Rs. 85.1, Rs. 86.6 and Rs.88.1, respectively, for 250 gm of paneer obtained from 1000 ml of buffalo milk.

**Keywords:** Incorporated, spinach powder, optimization, cost of production, expenses

## Introduction
Paneer is prepared by addition of organic acid into milk which is heating at 90 ºC. Paneer is tremendously used in vegetable dishes in Northwest Pakistan. Paneer is generally prepared by coagulation of buffalo milk. The final formed paneer and its quality depends on the quality of buffalo milk, quality of coagulant and temperature at which organic acid is added to milk for coagulation (Masud *et al.* 2007) [8]. Paneer is a high source of animal protein that is very inexpensive and serves as a significant supply of animal protein for vegetarians. In addition to having a high protein content and digestibility, paneer has a biological value of 80 to 86. Paneer is a low-cost form of animal protein that provides a large amount of animal protein to vegetarians which had higher digestibility (Shrivastava and Goyal, 2007) [11]. Paneer is a South Asian soft cheese made by acid and heat coagulation of milk. It is an unripened cheese that is non-fermentative, non-renneted and non-melting. Paneer is widely consumed in South Asia, either fresh or prepared in a variety of gourmet meals and snacks. Paneer manufacturing is currently widespread over the world. One aspect that has led to increased adoption of paneer in its ability to be deep-fried, making it a favourite for preparing appetisers like *pakoras* or fried paneer pieces. Paneer is a common raw ingredient in South Asia or the creation of a variety of gourmet meals and snacks Paneer manufacturing is currently widespread over the world (Aneja *et al.* 2007) [1]. The spinach leaves extract along with milk helps in the reduction of tooth discolouration which is caused by regular consumption of coffee. Most people feel chalky teeth after they consumed raw spinach leaves as salad this is due to oxalic acid content in spinach which is insoluble and deposits over teeth. Drinking milk will exaggerate spinach teeth sensation because oxalic acid is washed out along with milk and teeth become more whitish (Iskandar *et al.* 2018) [5]. Spinach has a full package of fibers, vitamins (*viz*. vit. A, C, E, K, $B_2$ and $B_6$), calcium, magnesium, manganese, iron, folic acid, protein and niacin with other flavonoids due to which it becomes most important leafy vegetable usually consumed after boiling or either fresh raw leaves as a salad. It is also a good source of chlorophyll which is helpful in digestion. Spinach leaves are also helpful in joint pain, inflammation of the lungs, bowel movement, thirst, sore eyes, ringworm scabies and leukoderma (Miri and Roughani 2019) [10]. Spinach leaf powder contains all nutrients such as protein, fiber, antioxidants, and minerals which makes spinach powder an ideal ingredient to be added in the formulation of foods with high nutritional and biological values. In the current experimental study, it is observed that spinach nano powder (0.50 percent, 1 percent, 1.50 percent and 2 percent) was used in the manufacturing of cheese. The quality of the cheese is raised by measuring its chemical composition, colour and sensory parameters.

Cheese containing 0.5 percent and 1percent spinach powder demonstrated high values for sensory parameters than other treatments (El-Sayed, 2019) [3]. In the last two decades of research, it was discovered that there is a paucity of information on the assessment of nutritional, pharmacological, and functional qualities of spinach, as well as the comparative analysis. To assess changes in the characteristics of ambient and cryogenic powdered black pepper, such a complete investigation is necessary.

## Material

### Experimental materials

The following material was used to meet the objectives of the current study.

### Collection of Buffalo Milk

Buffalo milk was collected from the local market of Latur city, of Natural Milk
Pvt., Ltd., Latur.

### Citric acid

Citric acid was collected from the local market and used for the preparation of Spinach incorporated paneer.

### Collection of Spinach powder

Spinach powder was prepared from spinach which was obtained from the local market of Latur city. It was washed, shade dried and then grinned to form fine powder with the help of mixer grinding.

### Chemicals

Analytical (AR) or guaranteed grade Reagents (GR) were used in the chemical analysis.

### Packing material

Polythene bags (200 gauge) obtained from the local market were used for packaging of Spinach incorporated paneer.

### Equipment and accessories

The equipment and machinery like texture analyzer (Instron Universal Testing Machine, Model-1000), hot air oven, muffle furnace, weighing balance, soxhlet, multimeter (fat, lactose, solid not fat and protein of milk), Kjeldahl apparatus, Stainless steel vessels of requisite capacity, knives, mixture, muslin cloth, standard weight balance, thermometer, gas shegadi and paneer press machine, etc. used for the preparation of paneer. Material and equipment was properly cleaned and washed with the detergent solution before using and all the precautionary measures were considered during the conduction of trials to avoid contamination.

## Methodology

Following procedures were followed during investigation

### Preparation of spinach powder

The fresh raw bundles of spinach were collected, washed, cleaned and shade dried for 5 days. After drying, bundles of dried spinach were grounded in a mixer for the formation of fine powder.

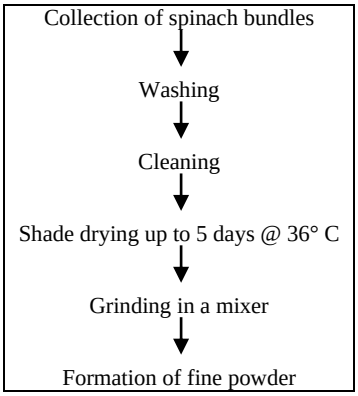


**Fig 1:** Flow chart for preparation of spinach powder.

### Preparation of paneer by using spinach powder

Paneer was prepared as per the method suggested by Gurud**i**tta *et al.* (2019) [4] with slight modification for the addition of spinach powder by using the following procedure as shown in the fig. 2. The buffalo milk with 6 percent and 9 percent solid not fat was filtered and then heated in a pan up to 90 ºC. Then milk was cooled to 80 °C. Before the addition of citric acid, spinach powder was added for uniform mixing. After cooling citric acid was added to milk @ 1-3 percent with stirring after complete coagulation held for 5 min for drainage of whey. The whey was drained through a stainless-steel strainer. The curd was collected and filled in stainless steel paneer hoop. The hoop used had circular blocks with holes on its side to facilitate the expulsion of whey. Paneer was pressed for 10-15 minutes @ 3 kg/cm$^2$ the pressed block of curd was removed from the hoop then cut into pieces and immersed in chilled water for 1-2 hours. The chilled paneer was then removed from the water to drain out and stored for cooling to room temperature (37 ºC) and packed in a polythene bag and finally kept for storage in a refrigerator @ 5 ºC.

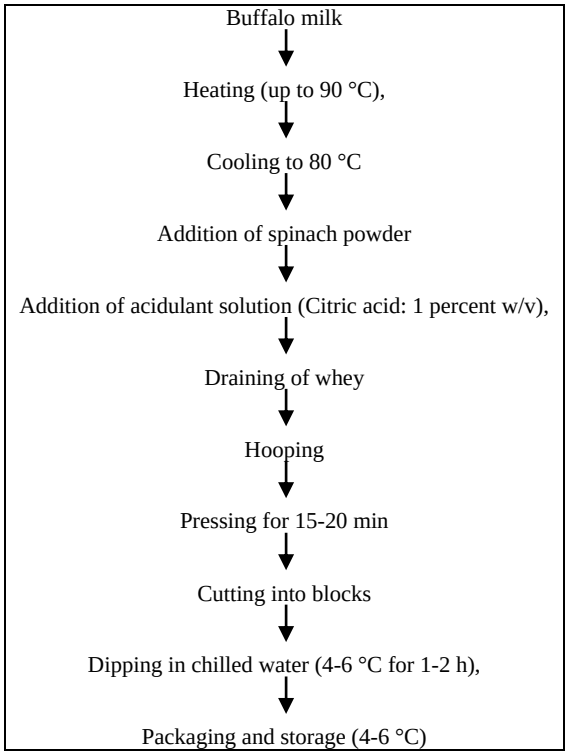


**Fig 2:** Flow chart for preparation of paneer. (Ref: Guruditta *et al.* 2019) [4]

**Cost of production of the finished product**
The ingredient and materials required for the preparation of the paneer incorporated with spinach powder were calculated based on the prevailing market price. The cost of fuel and other items were considered under miscellaneous charge and the cost of production was worked out.

**Preparation of paneer incorporated with spinach powder**
During preparation of spinach powder incorporated paneer addition of spinach powder was as per the treatments.

**Preparation of spinach powder**
The fresh raw bundles of spinach were collected, washed, cleaned and shade dried for 5 days. After drying, bundles of dried spinach were ground in a mixer for the formation of fine powder. In figure the sequence of preparation of spinach powder was shown.

**Preparation of paneer incorporated with spinach powder**
Before adding citric acid, the paneer was made by adding varying amounts of spinach powder. The quantity of spinach powder was retained by the treatments and research needs outlined in the protocol. The method for making paneer with spinach was shown in figure 2 and 3.

**Optimization level of paneer incorporated with spinach powder**
The paneer incorporated with spinach powder was made with clean, fresh buffalo milk that had 6 percent fat and 9 percent solid not fat. Spinach powder was added according to the prescribed procedure in figure 1 and 2. For optimization of proper spinach powder level in paneer fresh and clean buffalo milk was heated above 90 ºC for 5 min and then cooled to 80 ºC then recommended amount of spinach powder was weighed and added at 0.5, 1 and 1.5 percent on a weight basis to milk followed by continuous stirring to ensure uniform mixing of spinach powder into the milk as per treatment and procedure prescribed in methodology. Later on, 1 percent citric acid was added @ $80^0$C with continuous stirring which helps coagulate the milk. Holding it for 10 min helps in formation of white coagulated mass and separation of greenish watery whey. Drained the whey completely with the help of muslin cloth and it separates the whitish mass was obtained i.e. *channa* which was later on pressed 10-15 minutes @ 3 kg/sq. cm. to form paneer. Then pressed blocks were removed from hoop and immersed in chilled water @ 4 ºC for 2-3 hours then cut into pieces. During research it was indicated that as the amount of spinach powder rises the colour of paneer becomes more greenish and becomes healthier for the consumption-based nutrient content of spinach. There is a slight rise in green colour intensity occurs as the amount of spinach powder rises and the fourth paneer sample shows a darker greenish colour shade due to the presence of a high percentage of spinach powder (1.5 percent spinach powder on a wt. basis) as compared to first sample (0.5 percent of spinach powder on wt. basis). A panel of five judges used a 9-point Hedonic scale to evaluate the paneer samples for their colour, appearance, flavour, body and smoothness. The three treatments were chosen to more thoroughly evaluate the impact of spinach powder on paneer on a physico-chemical and sensory level. The treatment combinations were decided upon on a weight basis for paneer making using spinach powder as shown below. Similar methods of standardization were referred with some changes by Masud *et al.* (2007) [8], determined that Milk was standardised to 6% fat and 9% solid fat levels, and 1.5 litres were collected for each heating treatment in stainless steel containers heated to 75° C, 85 °C, or 95 °C, respectively for 5 minutes. The curd was salted at the rate of 1.5 percent by curd weight after being drained using a muslin cloth. Curd was then shaped and then pressed at room temperature for 2 to 3 hours then paneer was weighed and kept at 4 °C for further analysis. Jain *et al.* (2009) [9], stated that soy milk solution was heated to coagulation temperatures of 80, 85, 90, and 95 °C, respectively. The coagulants were progressively added while gently swirling continuously. After full coagulation, the contents were kept undisturbed at room temperature for 15 minutes. Whey was then strained out using a cheese cloth. The coagulum (Soy paneer) so formed was pressed for 45 minutes in a tiny wooden hoop at a pressure of 1.5 kg/cm$^2$. The soy paneer was taken out of the hoop and soaked in cooled water for 30 minutes before being withdrawn from the cold water. Kumar *et al.* (2019) [7], studied that the standardized cow's milk was heated to 90 °C then cooled to 85 °C, and coagulated by adding five different types of coagulants, namely citric acid, malic acid, alum, calcium lactate, and glucono-delta-lactone, at rates of 2, 1.6, 5.6, 6.8 and 7.7 g/litre of milk, respectively, with continuous gentle stirring until clear greenish-yellow whey was separated from the coagulated mass. These optimal coagulant strengths were identified in preliminary studies. The produced coagulum was kept undisturbed for roughly 5 minutes, and the temperature of the contents was not permitted to fall below 60° C at this point. Whey was drained by passing the contents through a fine cotton cloth. The coagulum was then placed in wooden hoops with apertures on all sides and the bottom to allow for rapid and effective whey ejection. Squeezed curd block was cut into pieces and submerged in cooled water (4° C) for 1 hour. The paneer was then removed from the water, thoroughly drained, and wiped clean before being utilised for further examination.

**Treatment combinations**
Following treatment combinations were considered for preparation of paneer with spinach powder.
$T_1$= Paneer from Buffalo milk (control)
$T_2$= Paneer with 0.5 percent of spinach powder by weight of buffalo milk
$T_3$= Paneer with 1 percent of spinach powder by weight of buffalo milk
$T_4$= Paneer with 1.5 percent of spinach powder by weight of buffalo milk

The paneer incorporated with spinach powder was created and utilized for future research after being mixed in *channa* according to the treatment and combination specified in the technique.

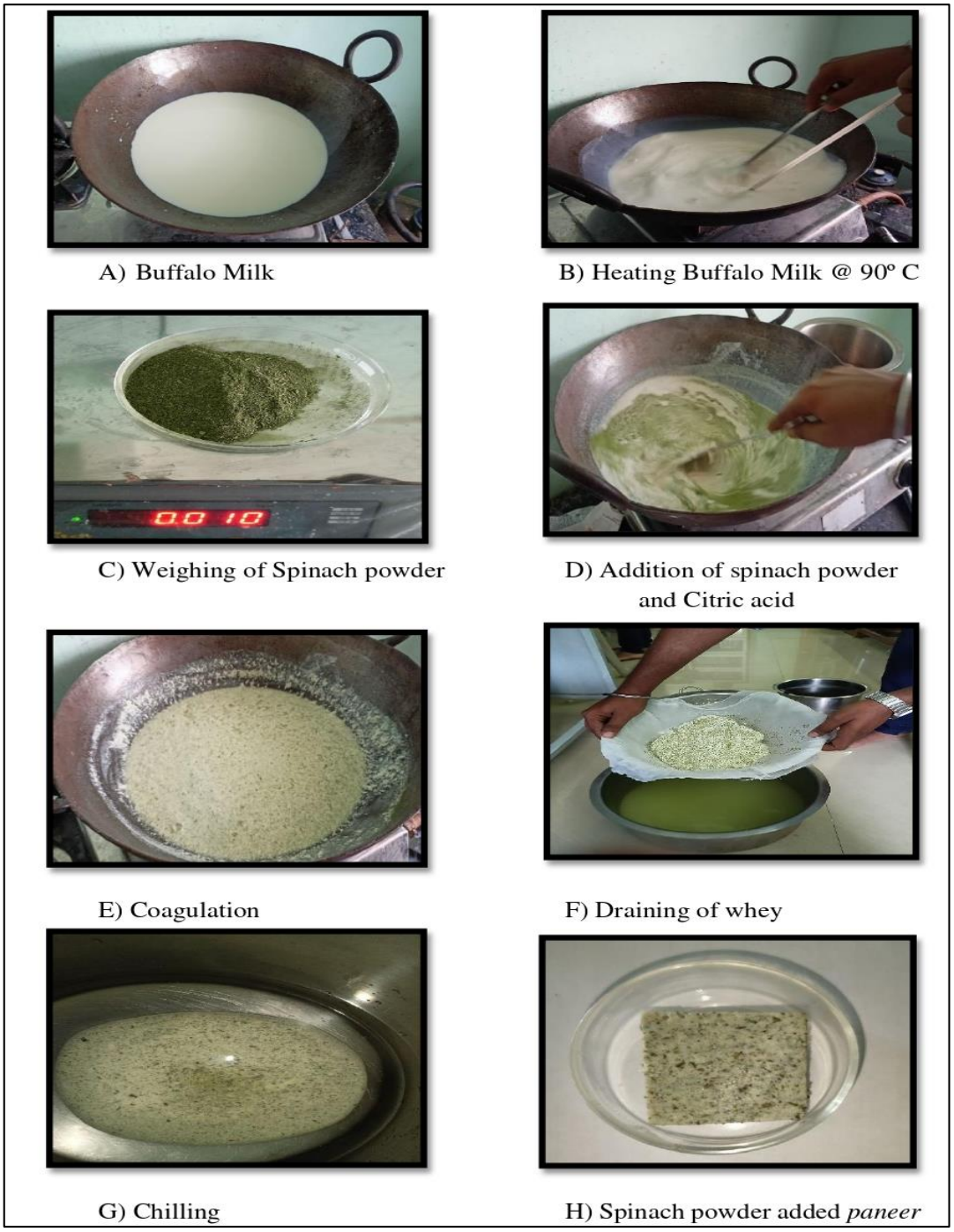


**Fig 3:** Procedure for preparation of paneer incorporated with spinach powder

**Yield of paneer obtained from different treatment combinations**

The yield and recovery of paneer made with spinach powder are shown in table 1. This study determined the yield of paneer for each of the four treatments $T_1$, $T_2$, $T_3$ and $T_4$.

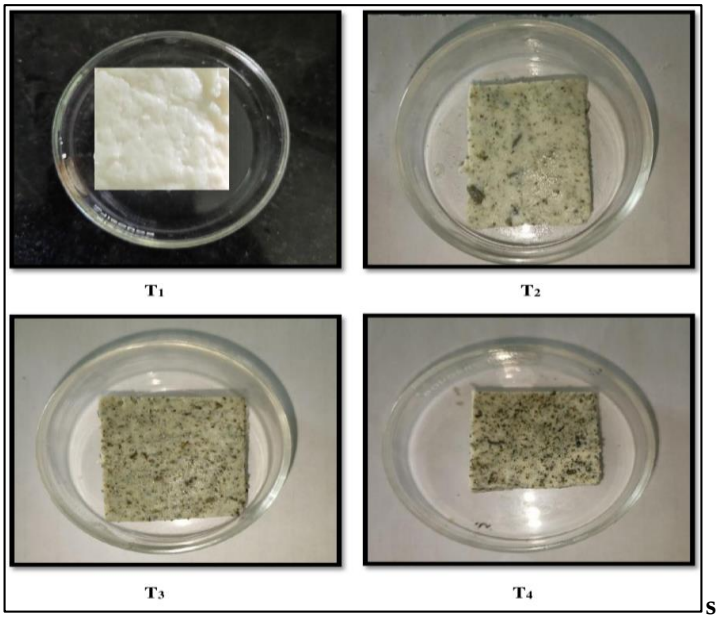


**Fig 4:** Treatment combination of paneer incorporated with spinach powder

**Table 1:** Yield of paneer obtained from different treatment combinations

| Treatment No. | Weight of *channa* used (gm) | Weight of spinach powder (gm) | Paneer obtained (gm) |
|---|---|---|---|
| $T_1$ | 250 | 0 | 250 |
| $T_2$ | 250 | 5 | 255 |
| $T_3$ | 250 | 10 | 260 |
| $T_4$ | 250 | 15 | 265 |

**Cost of production of paneer incorporated with spinach powder:** The manufactured spinach powder incorporated paneer that was calculated to determine the cost of production. The price of the components used to make spinach powder added to paneer, such as the cost of milk and spinach powder, were therefore taken into consideration when estimating the price of the finished product. Additionally, the expected costs for labour, gasoline, culture and other expenses have all been included. In Table 2 the cost of making the produced paneer has been estimated. For 250 g of paneer made from 1000 ml of milk, the cost of paneer preparation under the treatments $T_1$, $T_2$, $T_3$ and $T_4$ was Rs. 83.6, Rs. 85.1, Rs. 86.6 and Rs. 88.1, respectively. A portion of 1 kilo gramme of paneer with additional spinach powder cost Rs. 334.4, Rs. 333.7, Rs. 333.0 and Rs. 332.4 to prepare, for treatments $T_1$, $T_2$, $T_3$ and $T_4$, respectively. In the current study, it was stated that high-quality paneer, which is more expensive than conventional paneer, may be made using spinach powder combined with buffalo milk. The price of making the paneer can be decreased by utilising handmade shade dried natural spinach powder. It will be suitable for the general user in terms of purchasing power, with a predilection for high nutritional health beneficial characteristics. The cost of the generated spinach powder integrated paneer was seen to rise when the powder was added to subsequent paneer treatments. Subsequent research investigations are associated with relevant findings. Desale (2012) [2] observed that the paneer preparation expenses are reduced by employing a variety of herbal preservatives, including black pepper, cardamom, clove, black pepper + clove, black pepper + cardamom and clove + cardamom, to extend the shelf life of paneer. Paneer ranged in price per kilograms from Rs. 116.84 to 117.14. Mhatre (2018) [9] revealed that the price of making paneer also went up as the amount of ginger juice grew. Production of paneer cost Rs. 242.20, Rs. 245.70, Rs. 247.10, Rs. 249.30, and Rs. 252.50 per kg, at levels $T_1$, $T_2$, $T_3$ and $T_4$, respectively.

**Table 2:** Production cost of paneer incorporated with spinach powder

| Sr. No. | particular | Rate (Rs/ Kg) | $T_1$ | | $T_2$ | | $T_3$ | | $T_4$ | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Qty. (gm) | Amt. (Rs.) | Qty. (gm) | Amt. (Rs.) | Qty. (gm) | Amt. (Rs.) | Qty. (gm) | Amt. (Rs.) |
| 1 | Milk (ml) | 64 | 1000 | 64 | 1000 | 64 | 1000 | 64 | 1000 | 64 |
| 2 | Channa obtained (gm) | | 250 | | 250 | | 250 | | 250 | |
| 3 | Spinach powder (gm) | 300 / Kg | 0 | 0 | 5 | 1.5 | 10 | 3 | 15 | 4.5 |
| 4 | Citric acid per Kg | 96 | 1 | 9.6 | 1 | 9.6 | 1 | 9.6 | 1 | 9.6 |
| 5 | Total product obtained (gm) | | 250 | | 255 | | 260 | | 265 | |
| 6 | Miscellaneous | | | 2 | | 2 | | 2 | | 2 |
| 7 | Fuel charges (Rs.) | | | 3 | | 3 | | 3 | | 3 |
| 8 | Labour charges | | | 5 | | 5 | | 5 | | 5 |
| 9 | Total cost of obtained product (Rs.) | | | 83.6 | | 85.1 | | 86.6 | | 88.1 |
| 10 | Total cost per kg (Rs.) | | | 334.4 | | 333.7 | | 333.0 | | 332.4 |

## Conclusion

### Standardization

For optimization of proper spinach powder level in paneer fresh and clean buffalo milk was heated above 90 ºC for 5 min and then cooled to 80 ºC then recommended amount of spinach powder was weighed and added at 0.5, 1 and 1.5 percent on a weight basis to milk. Later on, 1 percent citric acid was added @ 80 ºC with continuous stirring which helps to coagulate the milk

### Production cost

The cost of paneer developed from adding spinach powder has been determined and is shown in Table 2. The cost of paneer preparation under the treatments $T_1$, $T_2$, $T_3$ and $T_4$ were as Rs. 83.6, Rs. 85.1, Rs. 86.6 and Rs.88.1, respectively, for 250 gm of paneer obtained from 1000 ml of buffalo milk. For treatments $T_1$, $T_2$, $T_3$ and $T_4$, the cost of preparing a total of 1 kilogram of spinach powder incorporated paneer was Rs. 334.4, Rs. 333.7, Rs. 333.0 and Rs. 332.4, respectively.

## References


1. Aneja RP, Mathur BN, Chandan RC, Banerjee AK. Heat-acid coagulated products. Technology of Indian milk products. A Dairy India Publication, Delhi, India; c2002. p. 133-158.
2. Desale RJ. Efficacy of herbal preservatives to enhance shelf-life of paneer (Doctoral Dissertation). MPKV. Rahuri; c2012.
3. El-Sayed MS. Use of spinach powder as functional ingredient in the manufacture of UF-Soft cheese. Heliyon. 2020;6(1):03278. Retrieved from (https.//www.cell.com/heliyon/pdf/S2405-8440 (20)30123-7.pdf) Accessed on January 12, 2021.
4. Guruditta H, Patel A, Arora A. Selection of dietary fibres for sucrose replacement in functional Chhana-Murki (Indian cottage cheese-based dessert) and their effect on sensory, physical, and instrumental texture parameters. International Journal of Dairy Technology. 2019;72(4):633-642.
5. Iskandar L, Santosa AS, Bambang I, Matram N. Effect of spinach leaf (*Amaranthus hybridus* L.) Extract solution and milk on the level of dental discoloration due to coffee. In Journal of Physics: Conference Series. 2018;1073(3):032021.
6. Jain S, Bakal S, Dissanayake T, Mathre S. Effects of coagulation temperature on the texture and yield of soy paneer (tofu). Journal of the National Science Foundation of Sri Lanka. 2009;37(4):263-267.
7. Kumar R, Mishra D, Sutariya H, Chaudhary MB, Rao KJ. Effect of different coagulants on the yield, sensory, instrumental colour and textural characteristics of cow milk Paneer. International Journal of Dairy Technology. 2019;72(4):617-625.
8. Masud T, Shehla S, Khurram M. Paneer (white cheese) from buffalo milk. Biotechnology & Biotechnological Equipment. 2014;21(4):451-452.
9. Mhatre MP. Studies on manufacture of paneer by incorporation of ginger (*Zingiber officinale* L.) (Master's thesis.). Balasaheb Savant Kokan Krishi Vidyapeeth, Dapoli; c2018.
10. Miri SM, Roughani A. Spinach. An important green leafy vegetable and medicinal herb. The 2nd International Conference on Medicinal Plants, Organic Farming, Natural and Pharmaceutical Ingredients; c2019. p. 1-6.
11. Shrivastava S, Goyal GK. A review on preparation of paneer. Indian Journal of Dairy Science. 2007;60:377-388.