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Physico-chemical and microbial properties of herbal quarg type cheese

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Abstract

Background: Cheese is one of the most popular manufactured dairy product. Cheese has been a part of well-balanced diet all over the world. Quarg is milky white in colour, may be even faintly yellowish, body and texture are homogeneously soft, smooth, good spreadable and it is essentially milk protein paste. Quarg cheese appeals to palate of Indian people who don't like the typical sharp flavour of other varieties of cheeses.

Method: Flavouring food is one of the most common uses for Herbs; almost each herbs is related to a specific flavour. Ashwagandha, turmeric, betel vine and tulsi are most common herbs traditionally used in Indian culinary dishes particularly spread. They also have both antioxidant and antimicrobial activities. Keeping this fact in view attempts would have been made to explore the flavour and antimicrobial effect of herbs in quarg type cheese. Initially, work was carried out to select the levels of four herbs (ashwagandha, turmeric, betel vine and tulsi) for the preparation of quarg type cheese and tried in preliminary study. After the selection of levels of herbs, the physico-chemical attributes determined were fat, protein, lactose, ash, total solids, acidity, pH and free fatty acid of quarg type cheese. The microbial quality of herbal quarg type cheese was studied in respect of SPC, YMC and Coliform count.

Results: The chemical composition of quarg type cheese prepared by using 0.3% Turmeric and 1.1% ashwagandha contains 11.31 and 11.15% fat, 13.01 and 12.94% protein, 2.05 and 2.08% lactose, 27.43 and 27.27% total solid, 1.05 and 1.09% ash, 0.68 and 0.69% acidity (% LA), 4.72 and 4.71 pH and the quarg type cheese prepared with addition of 0.3% turmeric and 1.1 percent tulsi had microbial count of fresh cheese for SPC 1.21 and 1.31 log cfu/gm. The yeast and mould count and coliform count was nil for all samples of herbal quarg type cheese.

Keywords: Quarg cheese, physico-chemical, microbial, ashwagandha, turmeric, betel vine, tulsi

Introduction

India is reckoned as a major threat in the dairying world by the rest of the world due to its immense potentiality. Dairy industry is of crucial importance to India. The Indian dairy industry is contributing significantly to the country's economy besides improving the health standards by increasing the nutrition value of the food. India is documented as the biggest and fastest growing market in the milk and milk products' world. India continuous to be the largest producer of milk in world. Several measures have been initiated by the government to increase the productivity of livestock, which has resulted in increasing milk production significantly. Milk production during 2019-20 and 2020-21 is 198.40 million tonnes and 209.96 million tonnes respectively showing an annual growth of 5.80%. The per capita availability of milk is around 427 grams per day in 2020-21. (Department of Animal Husbandry, Dairying & Fisheries Annual report, 2020-21). This also means that nearly more than 15% of the world's milk is produced in India and that too is growing nearly at a rate four times more than the global growth rate rendering India the status of the largest milk producing nation in the world. The most important triumph of the dairy industry is the near-self-sufficiency in milk production. The huge volume of milk produced in India is consumed almost entirely by the Indian population itself, in a 50-50 division amongst urban and non-urban areas. Increasingly, key consumers of the dairy industry are fast-food chains and food and non-food industries using dairy ingredients in a wide range of products. In spite of having largest milk production, India is a very inconsequential player in the world market. The objective of enhancing the export potential of our dairy products can be accomplished by value addition and product diversification besides, of course, achieving the global quality standards in our products.

Cheese may be defined as curd of milk separated from whey and pressed in solid mass there has been steady increasing in consumption of cheese in most country worldwide. There are more than 2000 varieties of cheese, although many have little difference in flavour from

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extremely mild to very sharp and in texture from semi solid to almost stone hard. The most popular variety of cheese is cheddar, mozzarella, feta, cottage, and quarg cheese.

'Quarg' the proper German name is spies quarg, is the natural unripe Ned, fresh cheese produced on large scale in Germany and is very popular there. It is essentially milk protein paste manufactured by proper bacterial culture with small amount of rennet addition for better separation of the protein coagulum from the whey and better yield. This cheese is popular in the central Europe (eg. Germany, Poland & Austria). Other names for this type of product in different countries include kvarg, tvarag, quarg, tworog, twarog, saurmilchquarg and speisquarg. Chakka and shrikhand is the product related to quarg popular in India.

Herbs

Herbs and spices are plants or parts, mostly leaves and seeds, that are used for their taste, flavour, aroma and imparting color in food products or for medicinal and functional properties. These are cultivated primarily in temperate and tropical climates and harvested to be used as flavoring or seasonings.

Ashwagandha (*Withania somnifera*)

Ashwagandha is referred to as Indian ginseng or winter cherry. One of the most esteemed medicinal plant used in Indian Ayurveda since centuries. It hails from Solanaceae family, grown in Africa, the Mediterranean, and India. Ashwagandha is considered to be a vitalizer, adaptogen, facilitating the ability to withstand stressors, and has antioxidant properties. Saponins and acylsterylglucosides in ashwagandha are anti-stress agents. Ashwagandha is characterized by the presence of steroidal lactones, alkaloids and flavonoids. Their root contains maximum amount of alkaloids- nicotine, somniferin, somniferine, somniferinine, withanine, withanone, withanolides, etc. Roots of the plant show hypotensive, bradycardiac, antitumor, respiratory stimulant activities and immuno-stimulating effect.

Turmeric (*Curcuma longa*)

Turmeric is widely used as a spice, preservative, coloring matter and has wide range of medicinal and pharmacological applications. It exhibits anti-inflammatory, anti-HIV, antibacterial, anti-oxidant, nematocidal, anti-parasitic, antispasmodic and anti-carcinogenic activities. Niranjana and Prakash (2008) reported that it is a potent scavenger of a variety of Reactive Oxygen Species (ROS) including superoxide anion, hydroxyl radical, peroxynitrite, etc. A total of 720 compounds, including 102 diphenylalkanooids, 19 phenylpropene derivatives, 529 terpenoids, 15 flavonoids, 7 steroids, 3 alkaloids and 44 compounds of other types isolated or identified from 32 species, have been phytochemically investigated in *Curcuma longa*. The biological activities of plant extracts mainly involve anti-inflammatory and antitumor activities.

Tulsi (*Ocimum basilicum*)

Basil is commonly known as *Tulsi*. Since ancient times, this plant is known for its medicinal properties. The aqueous extract of leaves of *Ocimum sanctum* showed significant reduction in blood sugar level in both normal and alloxan induced diabetic rats. Significant reduction in fasting blood glucose, uronic acid, total amino acid, total cholesterol, triglyceride and total lipid indicated the hypoglycemic and

hypolipidemic effects of tulsi in diabetic rats. This plant also showed anti-asthmatic, anti-stress, antibacterial, anti-fungal, antiviral, anti-tumor, gastric anti-ulcer activity, antioxidant, anti-mutagenic and immuno-stimulant activities. Peppermint and Basil (*Ocimum basilicum*) are traditionally grown crops in Europe and Central Asia for the production of fresh herb, dry leaves or essential oils. These plants portions find their applications as culinary herb or as minor adjuncts to salads and herbal tea and as aromatic agents in the food, pharmaceutical, functional food and nutraceuticals industries.

Beetle vine

Piper betel Linn. (Piperaceae) is a natural herb which is valued for its medicinal and therapeutic properties. Its leaves are widely used as masticatory by the Asian people. Leaves of betel vine are used with various condiments such as areca nut (Katha), cloves, cardamom, candied rose, and funnel for chewing purpose. Indian system of medicine and health has adopted the use of betel leaves in various ways. In India folkloric medicine, betel leaves is popular as an antiseptic and is commonly applied on wounds and lesions for its healing effects. (Datta *et al.*, 2011) [7].

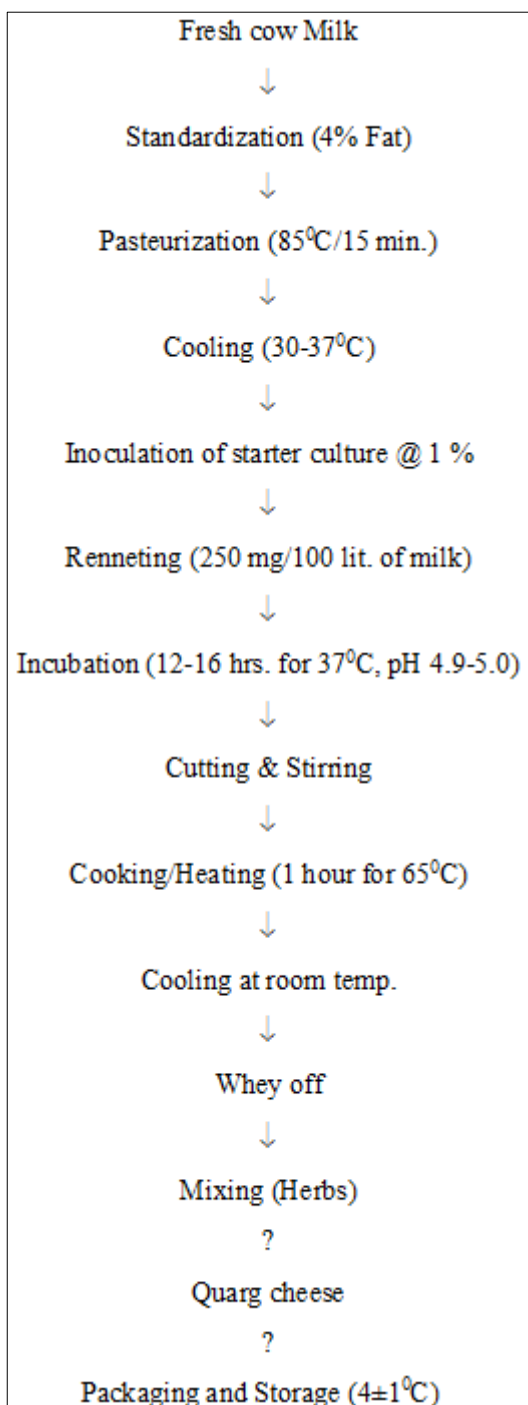
The medicinal properties of pan were recognized during 600 A D when Ayurvedic system of medicine came into practice. Betel leaves are beneficial to the throat and remove viscosity in human beings. Leaves help in digestion and tend to remove the bad smell of the mouth. The juice of betel leaves is used as an adjunct to pills administered in the Ayurvedic medicines. It is also good for the respiratory system and is used in treatment of bronchitis, cough and cold (Chopra *et al.*, 1956) [5]. Pan chewing is considered as a good and cheap source of dietary calcium. It increases digestive capacity when used with lime. Besides, it neutralizes the acidity and acts as blood purifier. Main constituents of betel leaves are vitamin B and C, carotene and other elements. Its chlorophyll is beneficial in maintaining healthy teeth, clearing the mouth and helping in a digestion by encouraging salivation and neutralizing excess acid.

Material and Methods

Fresh cow milk was obtained from Research cum development project on cattle, M.P.K.V. Rahuri. The cheese culture (NCDC-149) was procured from National Collection of Dairy Culture, Dairy Microbiology Division, NDRI, Karnal (Haryana). Microbial 'Meito' rennet was purchased from CHR Hansen Ltd. Mumbai to make the firm and desirable Quarg type cheese. Herbs were procured, Betel leaves and tulsi leaves as a source of natural herb from All India Coordinated Project on Medicinal and Aromatic Plants and Beetle vine Research, MPKV Rahuri, Dist. Ahmednagar. Ashwagandha and turmeric powder purchased from local market of rahuri.

Technology of herbal quarg type cheese

The quarg type cheese was prepared by using technology developed at NDRI, Karnal, prescribed by Gahane (2008) [10] with some minor modifications.



Flow chart of manufacture of herbal quarg type cheese

Analytical Methods

Chemical Analysis of Milk

Fat

By Gerber method as described in IS: 1224, Part-I (1977) [16]

Protein

As per Micro-Kjeldhal method prescribed in A.O.A.C (1992) [2]

Lactose

The lactose content of milk was determined by Lane Eynon method as per IS: SP 18, part XI (1981) [22].

Total solid

As per method given in IS: 1479, Part-II (1961) [17]

Ash

As per method given in IS: SP: 18 part XI (1981) [22]

Acidity

As per method given in IS: 1479, Part-I (1960) [18].

Microbial analysis of quarg type cheese

Standard plate count (SPC)

It will determine as per the dairy bacteriology manual of ICAR, (1982) [14]

Yeast and Mould count

It will enumerate as per the procedure described in IS: 5403 (1969) [19].

Coliform count

It will enumerate as per the procedure described in IS: 5401 (1969).

Statistical analysis

The data obtained from trials of final treatment replicated four times was analyzed by Completely Randomized Design (CRD) method by (Snedecor and Cochran, 1994) [39].

Results and Discussion

After selection of optimum level of herbs in quarg type cheese, the different treatment of quarg Type cheese was prepared and subjected to physico-chemical analysis and microbiological analysis. The treatment details are as under.

T₀: Control (Quarg type cheese)

T₁: Quarg type cheese added with 1.1% Ashwagandha

T₂: Quarg type cheese added with 0.3% Turmeric

T₃: Quarg type cheese added with 2.5% Betel vine

T₄: Quarg type cheese added with 1.1% Tulsi

Physico-chemical analysis of addition of herbs in quarg type cheese

The effect of different treatments on the physico-chemical attributes of Quarg cheese was analyzed and the result obtained is discussed below.

Table 1: Effect of addition of herbs on physico-chemical properties in quarg type cheese

Treatment	Fat	Protein	Lactose	TS	Ash	Acidity	pH	Moisture
T ₀	11.21 ^{ab}	12.79	2.04 ^c	27.15 ^{bc}	1.03 ^{bc}	0.71 ^a	4.69 ^{abc}	72.85 ^{abc}
T ₁	11.15 ^{abc}	12.94 ^{abc}	2.08 ^{ab}	27.27 ^{ab}	1.09 ^a	0.69 ^b	4.71 ^{ab}	72.73 ^{abc}
T ₂	11.31 ^a	13.01 ^a	2.05 ^{bc}	27.43 ^a	1.05 ^b	0.68 ^b	4.72 ^a	72.57 ^c
T ₃	10.93 ^{abc}	12.98 ^{ab}	2.10 ^a	27.05 ^{bc}	1.04 ^{bc}	0.72 ^a	4.67 ^{bc}	72.95 ^a
T ₄	11.13 ^{abc}	12.91 ^{bc}	1.99	27.06 ^{bc}	1.04 ^{bc}	0.70 ^a	4.68 ^{abc}	72.94 ^{ab}
SE±	0.2710	0.0242	0.0095	0.0789	0.0089	0.0068	0.0147	0.0789
CD @5%	0.8130	0.0729	0.0285	0.2378	0.0267	0.0204	0.0444	0.2378

Fat

The influence of different herbs treatments on the fat content of Quarg type cheese was detailed in table no. 1. It was revealed that there was significant (<0.05) difference between fat content of treatments.

The fat content of experimental quarg type cheese was in the range of 10.93 to 11.31. It was observed that the addition of herbs significantly (<0.05) increases the fat content of quarg type cheese T_2 (11.31) and decreased the T_1 (11.15), T_3 (10.93) and T_4 (11.13) compared to control sample (11.21). This effect may be attributed to compositional character. Fat content of Ashwagandha Powder was 0.3% - 0.4% (Sangita kumar, 2016) [37]. Fat content of Turmeric Powder was 5.1-5.3% (laith fareed, 2019) [29] Betel vine extract in 0.4-1.0% (Guha 2006), Fat content Tulsi extract in 3.60-4.0% (Simon, 1999).

The results obtained are in agreement with Milanovic *et al.*, (2004) [30] he studied the quality of quarg produced by probiotic application and he found that the fat content of the product was in the range of 12 to 14.5%.

Ratiba *et al.*, (2006) [36] found that the addition of cardamom, thyme and clove increases the fat content of soft white cheese from 46.08 (control) to 46.11 (treated sample).

Gahane (2008) [10] who reported that fat content in functional quarg cheese was 10%.

Kadiya (2009) [9] developed functional quarg cheese and observed the fat content of product was 10.16%.

Gad and salam (2010) [9] concluded that the use of plant extracts as a source of phenols is preferred as a natural method.

Kamal and Yousuf (2012) [24] concluded that the chemical composition of Turmeric is 69.4% carbohydrates, 5.1% lipids, 2.6% fiber and 6.3% proteins.

Kumar (2012) [27] developed sweetened functional soft cheese and found 14% fat in control and 12% fat in sweetened functional soft cheese.

Kumar *et al.*, (2013) [28s] conducted research to produce ice cream with various levels (2–4%) of Tulsi extract. When Tulsi extract is added, fat, protein, reducing sugars, non-reducing sugars, and total solids all decrease proportionately but the herbal ice cream has good acceptability among the consumers.

Trivedi *et al.*, (2014) [40] resulted that incorporation of Tulsi juice led to decrease in fat, protein, carbohydrates, ash and acidity and an increase in pH, melting resistance of ice-cream was reduced.

David J (2015) [8] resulted that the highest mean value for moisture percentage in Tulsi added shrikhand (13.50) was obtained from the treatments T_0 followed by T_1 (12.75), T_2 (12.00) and T_3 (11.18) Himanshu *et al.*, (2018) [12] developed Tulsi extract (0.9%) incorporated functional herbal shrikhand without compromising the physicochemical properties of the product.

Bhoite *et al.*, (2019) [4] reported that the fat content of ice-cream was found to decrease slightly as the level of PBL was increased. The lowest fat% was recorded for ice-cream containing 4% (T_3) PBL. Daraksha Iram *et al.*, (2022) reported that the composition of Turmeric in protein (6.3%), fat (5.1%), minerals (3.5%), carbohydrates (69.4%), moisture (13.1%) and essential oil (5.8 Ramteke (2022) [35] resulted that the addition of spices significantly ($p < 0.05 >$) increases the fat content of quarg type cheese than control sample.

Protein

The influence of different herbs treatments on the protein content of Quarg type cheese is detailed in table no.1. It is revealed that there was significant (<0.05) difference between protein content of treatments.

The protein content of experimental quarg type cheese was in the range of 12.79 to 13.01. It was observed that the addition of herbs significantly (<0.05) increases the protein content of quarg type cheese than T_0 (12.79) such as T_1 (12.94), T_2 (13.01), T_3 (12.98) and T_4 (12.91). The highest protein was observed in T_3 (12.98) followed by T_1 (12.94), T_4 (12.91) and T_2 (12.89) whereas lowest was in T_0 (12.79). This effect may be attributed to protein compositional characteristics of herbs. The results were in agreement of those reported by Bhoite *et al.*, (2019) [4] reported that the protein content was found ranging from 4.20 to 5.34%. As PBL is a good source of protein. The results were in agreement of those reported by Milanovic *et al.*, (2004) [30] he studied the quality of quarg produced by probiotic application and obtained quarg type cheese containing protein ranged from 10.20 to 18.24%.

Gahane (2008) [10] who reported that fiber and plant sterol addition increases the protein% in the representative treatments, total protein content in control and functional quarg cheese was 12.95 and 13.52% respectively.

Kadiya (2009) [9] developed functional quarg cheese and found protein content of product was 11.40%.

Kumar (2012) [27] developed sweetened functional soft cheese and found 12.50% protein in control and 14.29% protein in sweetened functional soft cheese.

David J (2015) [8] resulted that the Tulsi level increased the protein content in shrikhand were significantly increased.

Patange *et al.*, (2018) [34] found that cumin level increased the protein content were significantly increased.

Bhoite *et al.*, (2019) [4] reported that the protein content was found ranging from 4.20 to 5.34%. As PBL is a good source of protein.

Pal (2019) [33] resulted that the level of Ashwagandha added in shrikhand increased in the value of protein content.

Ramteke (2022) [35] resulted that the addition of spices significantly ($p < 0.05$) increases the protein content of quarg type cheese than control sample.

Lactose

The influence of different herbs treatments on the lactose content of Quarg type cheese is detailed in table no. 1. It is revealed that there was significant (<0.05) difference between lactose content of treatments.

The lactose content in resultant quarg type cheese is ranged from 1.99 to 2.10%. With addition of herbs there was significantly (<0.05) increased in lactose content in quarg type cheese. The highest lactose% was T_3 (2.10).

Milanovic *et al.* (2004) [30] found that the lactose content of the quarg cheese was ranged from 1.4 to 3.21%.

Gahane (2008) [10] analyzed the quarg cheese for lactose content and found 2.05% of lactose.

Kumar (2012) obtained 2.79% lactose in plain quarg cheese and 1.83% lactose in sweetened functional soft cheese.

David J (2015) [8] resulted that the highest mean value for lactose percentage herbal shrikhand compared to control shrikhand.

Ramteke (2022) [35] resulted that the addition of spices there was significantly ($p < 0.05$) increased in lactose content in quarg type cheese.

Total solid

The influence of different herbs treatments on the total solid content of Quarg type cheese is detailed in table no.1. It is revealed that there was significant (<0.05) difference between total solid content of treatments.

Total solid content in resultant quarg type cheese is ranged from 27.05 to 27.43%. The highest total solid% was found in T₂ (27.43) followed by T₁ (27.27), T₀ (27.15), T₄ (27.06) and T₃ (27.05). With addition of herbs there was significantly (<0.05) increased in total solid content in T₁ (27.27) and T₂ (27.43) and decreased in total solid content in T₃ (27.05) and T₄ (27.06) compared to control treatments (27.15) quarg type cheese.

Milanovic *et al.*, (2004) [30] observed the total solid content of the quarg cheese was 23.13 to 33.4%.

Gahane (2008) [10] found that 28% of total solid in control and 44.55% in functional quarg cheese.

David J (2015) [8] resulted that the highest mean value for total solid percentage in herbal shrikhand compared to control shrikhand.

Kumar *et al.*, (2013) [28] conducted research to produce ice cream with various levels (2-4%) of Tulsi extract. When Tulsi extract is added, fat, protein, reducing sugars, non-reducing sugars, and total solids all decrease proportionately but the herbal ice cream has good acceptability among the consumers.

Nidhi ojha (2018) [31] investigated that the effects of Tulsi and Turmeric Powder in herbal shrikhand, they reported that adding 0.4 percent Tulsi powder and Turmeric Powder 0.5% on the basis of chakka in improved the products sensory, microbiological activity and nutritional value.

Himanshu *et al.*, (2018) [12] developed Tulsi extract 0.9% incorporated functional herbal shrikhand without compromising the physico-chemical properties of the products.

Ramteke (2022) [35] resulted that the addition of spices there was significantly increased in total solid content in quarg type cheese.

Ash

The influence of different herbs treatments on the ash content of quarg type cheese is detailed in table no.1. It is revealed that there was significant (<0.05) difference between ash content of treatments.

Ash content in the resultant quarg type cheese is ranged from 1.03 to 1.09%. It was observed that the highest ash% found in T₁ (1.09) followed by T₂ (1.05) and T₃ (1.04) and T₄ (1.04) compared to T₀ (1.03). From the result it is revealed that the addition of herbs significantly (<0.05) increased the ash content of the product.

Milanovic *et al.*, (2004) observed ash content of quarg cheese was ranged from 0.7 to 1.19%.

Gahane (2008) [10] observed that 0.75% ash content in control quarg cheese and 0.98% ash in fiber and plant sterol added quarg cheese.

Kadiya (2009) [9] found that 1.48% ash content in quarg type cheese.

David J (2015) [8] resulted that the highest mean value for ash percentage in herbal shrikhand compared to control shrikhand.

Pal (2019) [33] resulted that the increased in the ash percentage as the level of Ashwagandha increases in shrikhand.

Ramteke (2022) [35] concluded that the addition of spices significantly ($p < 0.005 >$) increased the ash content of the

product.

Acidity

The influence of different herbs treatments on the acidity (% Lactic acid) content of quarg type cheese is detailed in table no.1. It is revealed that there was significant (<0.05) difference between acidity content of treatments.

The acidity (% lactic acid) of herbs treated quarg type cheese was ranged from 0.68 to 0.72 which was less than T₀ (0.71). The highest acidity found in T₃ (0.72) followed by T₀ (0.71) at par with T₄ (0.70) and T₁ (0.69) at par with T₂ (0.68). From the result it is revealed that addition of herbs significantly (<0.05) decreased in acidity content of T₁ (0.69), T₂ (0.68) and increased T₃ (0.72) and T₄ (0.70) compared to control samples (0.71). Increased in acidity of treated sample may be attributed to formation of lactic acid as a result of fermentation.

Kamruzamen *et al.*, (2002) [25] who analyzed physico-chemical properties of dahi stored at room and refrigerated temperature and found that pH decreased with an increase in acidity.

The acidity of fresh quarg cheese was found in the range of 0.67 to 0.70% (Gahane, 2008; Kadiya, 2009) [10, 9].

Shweta buch *et al.*, (2014) [38] resulted that the paneer in the present study was well within the reported normal range, it is surprising to notice that addition of Turmeric to paneer decreased the acidity of paneer, this effect may be attributed to possible alkaline nature of Turmeric.

Ramteke (2022) [35] concluded that addition of spice significantly ($p < 0.005 >$) increased in acidity content of resultant products.

pH

The influence of different herbs treatments on the pH content of quarg type cheese is detailed in table no.1. It is revealed that there was significant (<0.05) difference between pH content of treatments.

The pH of herbs treated quarg type cheese was ranged from 4.68 to 4.72. The highest pH was observed in T₂ (4.72) followed by T₁ (4.71) and T₄ (4.68) whereas lowest was in T₃ (4.67). It was observed that addition of different level of herbs reduces the pH of quart type cheese and the change in pH value of cheese followed an opposite trend to change in acidity (% lactic acid). The results were in agreement of those reported by Gahane (2008) [10] observed 4.52 pH value of fresh product as well as Kadiya (2009) [9] observed 4.60 pH value of quarg cheese.

Ramteke (2022) [35] concluded that the addition of different level of spices reduces the pH of quarg type cheese.

Moisture

The influence of different herbs treatments on the moisture content of quarg type cheese is detailed in table no.1. It is revealed that there was significant (<0.05) difference between moisture content of treatments.

The moisture content of herbs treated quarg type cheese was ranged from 72.57 to 72.95 which was less than control T₀ (72.85). The highest moisture content was observed in T₃ (72.95) followed by T₄ (72.94) and T₀ (72.85) whereas lowest was in T₂ (72.57). It was observed that the addition of different level of herbs *viz.*, T₁ (72.73) and T₂ (72.57) decreased the moisture content of quarg type cheese and addition of different level of herbs *viz.*, T₃ (72.95) and T₄ (72.94) increases the moisture content compared to control samples

T₀ (72.85). The results were in agreement of those reported by Pal (2019) [33] observed that the moisture content of control shrikhand was higher than the ashwagandha added shrikhand.

Microbial evaluation of quarg type cheese

The influence of different herbs treatments on the microbial quality of quarg type cheese is detailed in table no.2.

Table 2: Effect of herbs on microbial quality of fresh quarg type cheese

Treatments	SPC (Log cfu/gm.)	YMC (Log cfu/gm.)	Coliform (Log cfu/gm.)
T ₀	1.72 ^a	Nil	Nil
T ₁	1.52 ^b	Nil	Nil
T ₂	1.21	Nil	Nil
T ₃	1.45 ^b	Nil	Nil
T ₄	1.31 ^c	Nil	Nil
SE±	0.0150	-	-
CD@ 5%	0.0452	-	-

Standard plate count

It was observed that the standard plate count present in the experimental treatments ranged from 1.21 log cfu/gm. to 1.72 log cfu/gm. It is revealed that there was significant (<0.05) difference between standard plate count of the treatments. The lowest count was found in T₂ (1.21 log cfu/gm.) followed by T₄ (1.31 log cfu/gm.), T₃ (1.45 log cfu/gm.), T₁ (1.52 log cfu/gm.), where, as highest count observed in T₀ (1.72 log cfu/gm.). It was found that the addition of herbs reduces the standard plate count in the resultant quarg type cheese than control sample. This might be due to combine effect of antimicrobial compound present in the herbs.

The result of yeast and mould count and coliform count showed that the average initial ymc and coliform count in quarg type cheese was nil in the entire sample.

The result found are in close agreement with Belewu *et al.*, (2005) [3] who observed the ginger was most effective to reduced microbial load followed by garlic in West African soft cheese.

Kriangkrai and penkhae (2009) [26] who reported that gram positive bacteria are more sensitive to the antimicrobial activity of piper betel.

Hosney *et al.*, (2011) [13] who found that coliform bacteria count was not detected in the karischem cheese sample made by adding *Curcuma longa* at the end of cold storage period.

Patange *et al.*, (2018) [34] found the close result in WPC fortified quarg cheese.

Laith fareed *et al.*, (2019) [29] the result indicated that as the concentration of the Turmeric Powder increased the total bacterial count decreased compared with control treatments which showed the highest total count after 9 days of storage at 5±2 °C.

Ramteke (2022) [33] concluded that the addition of spices reduce the standard plate count in the resultant quarg type cheese than control sample.

Conclusions

The highest chemical composition of quarg type cheese prepared by using 0.3% turmeric powder and 1.1% ashwagandha powder contains fat (11.31 and 11.15%), protein (13.01 and 12.94%), lactose (2.05 and 2.08%), total solid (27.43 and 27.27%), ash (1.05 and 1.09%), acidity (0.68 and 0.69%) and pH (4.72 and 4.71%).

The quarg type cheese prepared by 0.3% turmeric powder and 1.1% tulsi extract has lowest microbial count of fresh cheese for SPC 1.21 and 1.31 log cfu/gm. The yeast and mould count and coliform count was nil for all samples of quarg type cheese. Thus, it is concluded that herbs has an effective impact against microbial quality of cheese.

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